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YOUNG (G. Y.). **Root rots in storage of deciduous nursery stock and their control.**—*Phytopathology*, xxxiii, 8, pp. 656–665, 1 graph, 1943.

Freezing, induced by lack of care in nursery practices, was found to be the primary cause of a root rot of stored stock of deciduous trees and shrubs which has been responsible for extensive damage in the Upper Mississippi Valley of recent years, among the species affected being black locust (*Robinia pseud-acacia*), Osage orange (*Maclura pomifera*), Russian mulberry (*Morus alba* f. *tatarica*), black walnut (*Juglans nigra*), wild plum (*Prunus americana*), bur oak (*Quercus macrocarpa*), and tulip tree (*Liriodendron tulipifera*). In the course of experiments in the autumn of 1938 in an Iowa nursery, in which a large number of species, besides those enumerated above, were subjected to a wide variety of in- and outdoor storage conditions, it was observed that plants injured through insufficient protection against frost were invaded by several kinds of fungi, *Fusarium* and *Alternaria* predominating. In wound inoculations, the former caused small local lesions on the roots of healthy specimens, but in no case did appreciable infection develop, and it is concluded that the particular form of deterioration in question may be reduced to a minimum by appropriate precautions, including the lifting and handling of stock at temperatures above freezing, deep heeling-in, preferably in loamy soils, for outdoor storage in northern nurseries, and the maintenance in sheds, root cellars, caves, and the like of a temperature ranging from 34° to 50° F. and a high relative humidity.

SHOPE (P. F.). **Some Ascomycetous foliage diseases of Colorado conifers.**—*Univ. Colo. Stud.*, Ser. D, ii, 1, pp. 31–43, 1943.

This paper gives information on 34 foliar diseases of Colorado conifers caused by Ascomycetes. Brown or black felt blight (*Neopeckia coulteri* and *Herpotrichia nigra*) [*R.A.M.*, ix, p. 75] is prevalent above 8,000 ft., affecting only seedlings and the lower branches of trees buried under snow during the winter and early spring. *N. coulteri* is found exclusively on pines, whereas *H. nigra* attacks other species also. Moreover, the ascospores of the former are normally bicellular and dark brown (*Phytopathology*, vi, pp. 357–359, 1916), while those of the latter are quadricellular and olivaceous. The mat-covered needles on blighted branches recently exposed by the melting snow are still green, but they eventually die and turn brown, while at the same time the originally black mat assumes a brownish tinge. The fungus often found growing on the mats of *H. nigra*, which is characterized by blackish, ovoid fructifications containing quinqueseptate ascospores, was identified by Seaver (*Mycologia*, vii, pp. 210–211, 1915) as *Mytilidion fusisporium*, Weir's determination of it (*J. agric. Res.*, vi, pp. 277–288, 1916) as a new species, *H. quinqueseptata*, being rejected.

In August, 1940, inconspicuous, dark brown apothecia, ½ to 1 mm. in diameter, with stellate apertures, were detected on the previous year's foliage of *Juniperus scopulorum*, at 8,000 ft. Two years later, the current season's needles were found to bear yellowish spots, less than 1 mm. in diameter, which may represent primary

infections. The relatively few ascocarps of the 1940 collection were occupied by asci containing four brown, smooth-walled, unequally bicellular spores, 15 to 17 by 11 to 13 μ. Material was submitted to G. D. Darker, who diagnosed the fungus as in all probability a new species of *Keithia*, or at least a new variety of *K. tetraspora*, the spores of which measure 21 to 24 by 13 to 16 μ (*Mycologia*, v, pp. 6–11, 1913). The author believes the juniper pathogen to be a new species, which he proposes to name *K. tetramicrospora*, a detailed diagnosis being withheld until further data and more fruit bodies are obtained. The disease affected only small trees (under 10 ft. in height) and the lower branches of larger ones, which would have been under snow during the winter.

Needle blight (*Rhabdocline pseudotsugae*) of Douglas fir [*Pseudotsuga taxifolia*] is of rare occurrence and little importance in the dry climate of Colorado.

Snow blight of *Abies lasiocarpa* is caused by *Phacidium balsameae* Davis, and the same disease of *Pinus flexilis* by *Phacidium planum* Davis, the latter species occurring solely in association with *Hypoderma saccatum*. Collections of these organisms were also made from the lower branches of trees growing at high altitudes, where the winter snow cover usually exceeds 15 ft. in depth. The ascospores mature in the late summer and are shed towards the close of the growing season.

Of the 41 North American species of needle-cast fungi listed by Darker [*R.A.M.*, xii, p. 254], 13 are known to be present in Colorado. These are enumerated with annotations and a key.

Hahn (G. G.) & Ayers (T. T.). **Role of Dasyscypha willkommii and related fungi in the production of canker and die-back of Larches.**—*J. For.*, xli, 7, pp. 483–495, 3 figs., 1943.

Wound-inoculation experiments conducted from 1930 to 1934 under controlled conditions in the field and in a greenhouse with cultures and apothecia of *Dasyscypha willkommii* demonstrated its capacity to infect injured tissues, cankers and die-back being induced on both vigorous and sickly larches of various species (*Larix laricina*, *L. leptolepis*, *L. decidua*, *L. occidentalis*, and *L. gmelini*). Apothecia were produced experimentally on the lesions only in a very few cases; the ascospores arising therefrom developed in malt agar cultures in the manner typical of *D. willkommii*, which was also readily reisolated from the mycelium commonly present in and on the canker tissues. The reisolates were not used for further tests in the United States, but T. R. Peace, of the Forestry Commission of Great Britain, carried out independent experiments at Oxford with the writers' material, which gave positive results on *L. decidua*.

In comparable field experiments by the authors with three related species, namely, *D. calycina*, *D. oblongospora*, and *D. occidentalis* [*R.A.M.*, xvii, p. 422], no growth was obtained either on healthy or sickly trees of *L. decidua*, *L. laricina*, or *L. leptolepis*. In contrast to *D. willkommii*, the saprophytes colonized the desiccated tissues distal to the girdling canker lesions.

The tests herein described, as well as those of Peace in England, have conclusively established the ability of *D. willkommii* to assume a pathogenic form without the concurrence of frost damage.

Roth (L. F.) & Riker (A. J.). **Life history and distribution of Pythium and Rhizoctonia in relation to damping-off of Red Pine seedlings.**—*J. agric. Res.*, lxvii, 4, pp. 129–148, 2 figs., 1943.

In a study of fungi causing damping-off of red pine (*Pinus resinosa*) seedlings [*R.A.M.*, xxii, p. 158] in Wisconsin, *Pythium irregulare* and *Rhizoctonia* [*Corticium*] *solani* were found to be the most destructive; *Fusarium* spp. were also isolated but proved, in inoculation tests, to be only slightly, or not at all pathogenic. The

symptoms induced by *P. irregulare* and *C. solani*, when operating alone (in soil inoculated with pure cultures), were distinct and appeared to be correlated with the growth habit of each. *P. irregulare* attacked the roots at any depth in the soil; attacks above the soil surface occurred only under very humid conditions, when growing over dead tissues. The point of infection appeared to be determined by the age of the tissues, the moisture content of the soil, and the location of the fungus. The attack by *C. solani* was mostly confined to the upper $\frac{1}{2}$ in. of soil and to saturated air immediately above ground. Seedlings with elongating hypocotyls were subject throughout to attack by aerial mycelium of *C. solani*. After elongation had ceased, however, cotyledons and the primary shoot appeared to be the susceptible parts above ground. Minute mechanical injuries to the base of the hypocotyl greatly increased damping-off. The injury from clipping the cotyledons had no effect on susceptibility to *C. solani* but considerably increased that to *P. irregulare*. These results agreed with the nursery observation that bird injury also increases damping-off.

The life-history of the two fungi in relation to pathogenesis is relatively simple; both live in the soil and invade injured seedlings more easily than uninjured ones, they spread locally by growth through the soil, and at a distance by means of contaminated soil or other material, and they are capable of surviving for more than a year in sandy soil. *C. solani* survived well in soil containing only 10 per cent. of moisture and dry enough to blow as dust. Both fungi were commonly found in Wisconsin, but the predominance of the one over the other was influenced by weather, soil type and acidity, and ground cover. Little or no damping-off was associated with jack pine (*Pinus banksiana*) or jack oak (*Quercus ellipsoidalis*) cover on Plainfield sand. Discussion of the apparently strong influence of acidity, temperature, and moisture on the disease is reserved for later papers.

Andrews (S. R.) & Gill (L. S.). **Western red rot in immature Ponderosa Pine in the southwest.**—*J. For.*, xli, 7, pp. 565–573, 3 graphs, 1943.

During 1938–9 a survey was made in Arizona and New Mexico to determine the importance of western red rot (*Polyporus anceps* or *P. ellisianus*) in immature *Pinus ponderosa* stands [*R.A.M.*, xxi, p. 234]. Analysis of dead branches indicated that small ones (0·6 to 1 in. in basal diameter) were of relatively low susceptibility, while large ones (upwards of 1·1 in.) were liable to severe infection. In stands under 40 years old, the percentage of trees with at least one diseased branch was generally low; it was also erratic, and showed no correlation with any of the physical characters of the stands. In stands 41 to 100 years old, the incidence of infection was often high and closely correlated with all the measured characters except age. Analyses limited to this age group denoted that the effect of age increased directly with (1) the percentage of trees with one or more large dead branches, and (2) the percentage of trees exceeding 5 in. in diameter at breast-height. Infection was also found to increase as stand density decreased. Analyses of centre rot of branches dissected during the survey suggested a negligible incidence of decay below 40 years, with a rapid proportional increase above that age.

Wherever possible, a proposed crop tree should be examined for infection by western red rot: if a branch infected at the base is found, the tree is not worth further pruning and a substitute should be selected. Small-branched trees should be used as far as practicable, and the stands maintained in a high state of density for the first 80 years.

Walters (C. S.). **Treating fence posts with pentachlorphenol-fuel oil solutions.**—*J. For.*, xli, 4, pp. 265–268, 1943.

Very satisfactory results have been obtained in Illinois by the soaking of fence posts in a cold solution of 5 per cent. pentachlorophenol-fuel oil [cf. *R.A.M.*, xxii,

p. 47], the procedure being simple, economical, and particularly suitable for farm use. The posts can be treated either by full-length horizontal immersion in a stock tank or by standing them upright in 65-gal. steel oil drums and reversing the ends. An average-sized post (4·8 in. in top diameter, 1 cu. ft. in volume), absorbing ½ gal. of the solution, can be produced for a total cost of about 40 cents, excluding that of the equipment. A period of 48 hours usually suffices for the complete treatment of white pine wood. As regards hardwoods, to judge by the absorption of solution and penetration of sapwood, *Catalpa* was the most difficult, and red and black oaks and hickory the easiest. The preservative is apt to cause dermatitis unless the workers' arms and hands are adequately protected, preferably with 'neoprene' rubber gloves.

WARNE (L. G. G.). **A case of club-root of Swedes due to a seed-borne infection.**—*Nature, Lond.*, clii, 3861, p. 509, 1943.

The author records three outbreaks of club root of swedes (*Plasmodiophora brassicae*) in a Manchester garden, in which the evidence pointed to a seed-borne infection. This is believed to be the first record of an outbreak of club root due to contaminated seed.

With the small amount of seed obtained from one of these diseased crops, sowings were made in boxes of sterilized compost of two varieties of swede, Best-of-All and Conqueror, and also of Brussels sprouts, Cambridge No. 5 variety, as controls; for each variety one box was sown with untreated seed and one with seed surface-sterilized with hypochlorite; and furthermore, two boxes of Brussels sprouts were immediately after sowing watered with swede seed washing obtained by soaking the seed in distilled water over-night. Examination of all the plants after harvesting showed that boxes sown with seed of both varieties of swedes developed considerable numbers of infected plants: 52·5 per cent. in Best-of-All and 15·6 per cent. in Conqueror swedes. Surface sterilization reduced these percentages to 41·3 and 1·6, respectively, indicating that the contamination of Best-of-All swedes is more adherent and consequently less easily removed by hypochlorite or water than is that of Conqueror. This is of importance in interpreting the other results obtained, namely that control plants watered with Best-of-All seed washings showed no infection, whereas those watered with Conqueror seed-washings developed 16·7 per cent. It is concluded that the disease is seed-transmissible, probably owing to surface contamination resulting from contact with infected soil.

OSMOND (D. A.). **A note on heart-rot in Sugar Beet in Herefordshire.**—*Rep. agric. hort. Res. Sta. Bristol, 1942*, pp. 46–48, [1943].

A survey made in 1942 in Herefordshire showed that heart rot of sugar beet due to boron deficiency [*R.A.M.*, xv, p. 626] was fairly widespread in that county, being present in 17 out of the 41 fields visited. Soil examination gave the following average values: centres free from disease had a calcium carbonate content of 0·14 per cent., P_H 6·32, and 8·09 p.p.m. of water-soluble boron; while the corresponding values for centres with severe symptoms were 1·67 per cent., P_H 7·17, and 4·91 p.p.m. It thus appears that heart rot is associated with a low water-soluble boron, and a relatively high calcium carbonate content of the soil coupled with P_H values of over 7. In pot experiments, heart rot was observed to occur under conditions favouring either drought or poor aeration. It is recommended that farmers intending to lime for sugar beet should have the soil tested beforehand. The application of heavy dressings of lime just before planting is not generally advised; where lime must be given, it is better to apply it at some point in the rotation other than immediately prior to the sugar beet crop.

CROXALL (H. E.) & OGILVIE (L.). **Experiments with protectant seed dressings, 1940–42.**—*Rep. agric. hort. Res. Sta. Bristol, 1942*, pp. 65–76, [1943].

Further greenhouse and field experiments with seed treatments against pre-emergence damping-off of peas [*R.A.M.*, xix, p. 640] showed that in garden soil, where the seed was exposed to infection, increased emergence could be obtained by treating the seed with either cuprous oxide (red or yellow), proprietary organo-mercury dressings, or spergon, at all dosages used (0·125, 0·25, and 0·5 per cent. of the weight of seed). When damping-off was severe the cuprous oxides were somewhat more effective than the organo-mercury dressings applied at the same rate, the yellow oxide being rather more effective than the red. There was no significant difference between the bright red and dark red cuprous oxides, nor was their efficiency impaired by the addition of graphite as a lubricant. The cuprous oxides, particularly the yellow, even when applied at the lowest rate, appeared more likely to cause injury to pea seed than the mercurial dressings, especially to the round seed variety Foremost in dry soil. It is, therefore, not recommended to use yellow cuprous oxide for pea seed treatment; while red oxide applied at a rate not higher than 0·25 per cent. can be used safely unless the soil is abnormally dry. Organo-mercury dressings are considered safe at the dosage recommended by the makers (0·25 per cent.). A reduced germination was caused by a mercurial dressing only in one test, when double the recommended dose was applied. In the few experiments with spergon promising results were obtained and it is considered to be worthy of further trials.

Isolation and inoculation experiments showed that *Pythium* spp. are mainly responsible for damping-off. *Rhizoctonia* [*Corticium*] *solani* was isolated in relatively few instances, but proved capable of causing decay of germinating pea seeds. This fungus was also observed by C. J. Hickman in the field in Worcestershire on peas which had failed to germinate. Onion, cabbage, savoy, and flax stands were not significantly increased by seed treatments, but emergence of tomato seed was improved by treatment with red cuprous oxide at 2 per cent. and yellow cuprous oxide at 0·25, 0·5, and 1 per cent. dosages, and with the proprietary organo-mercury M 1 at the 1 per cent. dosage. Seed treatment for tomato is regarded, however, only as a substitute for sowing in sterile soil.

WALKER (J. C.) & JOLIVETTE (J. P.). **Productivity of mosaic-resistant Refugee Beans.**—*Phytopathology*, xxxiii, 9, pp. 778–788, 3 graphs, 1943.

In a comparative investigation in Wisconsin, covering the period from 1937 to 1939 and resumed in 1942, on the yield, pod shape, rate of production, and canning quality of the mosaic-susceptible Stringless Green Refugee bean and five resistant varieties, four of the latter, viz., Idaho Refugee, U.S. No. 5 Refugee, Sensation Refugee 1066, and Sensation Refugee 1071, approximated closely to the improved Stringless Green Refugee (raised from mosaic-free seed) in cropping capacity and production rate. Sensation Refugee 1066 was consistently the earliest of all the varieties in pod formation at the canning stage, while Wisconsin Refugee matured later than the other four resistant sorts and usually failed to equal them in total yield. Pod shape and dimensions were practically uniform in the resistant varieties and the susceptible one, nor were there any differences between the comparative material in canning quality. In short, all the desirable characters of the original susceptible variety seem to have been retained in the resistant lines, but an attempt should be made to eliminate from Wisconsin Refugee and Idaho Refugee by further selection a variegation inherited from the resistant parent (Corbett Refugee), which is masked at high temperatures; it causes the production by affected plants of distorted pods unsuitable for processing [cf. *R.A.M.*, xix, p. 450].

Daines (R. H.). **Soft rot of Sweet Potatoes and its control.**—*Bull. N.J. agric. Exp. Sta.* 698, 14 pp., 2 figs., 1942. [Abs. in *Exp. Sta. Rec.*, lxxxix, 4, p. 457, 1943.]

At least nine species of *Rhizopus*, with *R. nigricans* [*R. stolonifer*] predominating, are implicated in the etiology of soft rot, reported to be the most destructive post-harvest disease of sweet potatoes in New Jersey. The pathogen may develop through a temperature range of 38° to 107·6° F., its optimum lying between 65° and 73·4°, with an atmospheric humidity at the higher figure of 75 to 84 per cent. Preventive measures should include sanitation of storehouses and hampers, exclusion of rodents, avoidance of frost damage and sun scald, careful handling from harvest to storage, and maintenance of appropriate temperature and moisture conditions. For the 10- to 14-day curing period, a temperature of 80° to 85° and a relative humidity of 90 per cent. are recommended, followed by storage of the roots at 55° with a relative humidity of 85 to 90 per cent. The loss from soft rot on the market was significantly reduced by immersion of the roots in borax solutions after storage, but pending further knowledge as to the effects of the chemical on human health, this procedure cannot be generally advocated. A sodium hydrogen carbonate dip improved the appearance of the pale-coloured varieties.

Tucker (C. M.) & Routien (J. B.). **The mummy disease of the cultivated Mushroom.**—*Res. Bull. Mo. agric. Exp. Sta.* 358, 27 pp., 8 figs., 1942. [Abs. in *Exp. Sta. Rec.*, lxxxix, 4, p. 459, 1943.]

Heavy losses have been caused in mushroom caves and houses in Missouri since 1935 by an obscure disease responsible for the development of abnormal sporophores, with elongated, slender stipes and small, tilted pilei: in advanced stages of infection most of the fruit bodies are arrested at the button stage, becoming grey or brown, dry, spongy, and mummified. The disease spreads through the bed at the rate of about 1 ft. daily, resulting in total failure of the affected areas. Transmission has been secured only by the transference of casing soil or compost from diseased to normal beds, the causal organism being present in these materials to a distance of 4 to 6 ft. in advance of the youngest visibly affected sporophores. The usual incubation period is about three weeks. Cultures of various micro-organisms from diseased sporophores failed to initiate infection. The infectivity of soil and compost from affected beds is rapidly destroyed by drying, moderate heating, or chemical treatment, which at the same time, however, would kill the mushroom mycelium. The rate of spread and difficulty of transmission suggest the causation of the disease by a virus transferable only by anastomoses between infected and normal hyphae. The progress of the pathogen was obstructed by the provision of narrow trenches across the beds 6 to 8 ft. beyond the visibly affected sporophores, and to a lesser extent by mercuric chloride barriers, while in commercial houses it has been reduced to unimportant proportions by the division of beds into short sections by double cross boards with a narrow air space between them.

Kassanis (B.). **Neutralization of some plant viruses by rabbit sera.**—*Brit. J. exp. Path.*, xxiv, 4, pp. 152–159, 1943.

The non-specific neutralization of the tobacco mosaic, tomato bushy stunt, and tobacco necrosis viruses by normal and heterologous sera was so extensive in the writer's experiments at Rothamsted that the additional specific effect of homologous anti-sera was relatively small [*R.A.M.*, xx, p. 316]. Specific neutralization was of use for the demonstration of serological relationships only in comparative tests on sera of the same age and similarly stored.

Unfrozen sera rapidly lost their non-specific neutralizing properties on storage. All heterologous anti-sera reduced the infectivity of the viruses to a greater degree than normal sera stored under comparable conditions.

Precipitating anti-bodies did not appear to be responsible for neutralization. No correlation was established between precipitin titre and neutralizing capacity, which was not affected, moreover, by the removal of precipitins. Only quantitative differences were observed in the behaviour of homo- and heterologous sera, the infectivity of all virus-serum mixtures being restored by dilution.

FULTON (R. W.). **The sensitivity of plant viruses to certain inactivators.**—*Phytopathology*, xxxiii, 8, pp. 674–682, 1943.

The sensitivity of tobacco mosaic, potato ring spot [potato virus X], cucumber mosaic, tobacco ring spot, and bean mosaic to inactivation by trypsin, milk, extract of *Phytolacca decandra*, bovine serum, and *Aspergillus niger* growth product was determined [cf. *R.A.M.*, xxi, p. 48]. Generally speaking, the sensitivity of the viruses to the inactivators increased in the order given above, but the specific responses of bean mosaic, tobacco ring spot, and cucumber mosaic to certain inactivators involved a reversal of these relationships. Although the extracts of tobacco mosaic and potato ring spot were much more concentrated than those of the other viruses, they did not require a much higher strength in the inactivators. The percentage of tobacco mosaic inactivated reached a maximum when the mixture with inactivator was most concentrated, and fell to a minimum at the greatest dilution. On the whole, the results supported the theory that the 'non-toxic' inactivators affect the virus and not the host.

Plant diseases and insect pests. Notes by the Biological Branch.—*J. Dep. Agric. Vict.*, xli, 8, pp. 413–417, 6 figs.; 9, pp. 463–468, 6 figs., 1943.

The growing of lettuce varieties from California, including Imperial D, Imperial F, Imperial 847, and Imperial 615, is stated to have provided satisfactory control of downy mildew (*Bremia lactucae*) [*R.A.M.*, xx, p. 341] in Victoria prior to the appearance of a new strain of the fungus, which rendered all these varieties susceptible. Until new resistant varieties are produced, growers are advised to drench seedlings with 4–4–40 Bordeaux mixture during the first week of growth and again about four days prior to transplanting. This treatment will protect the plants in the seed-bed, but is unsatisfactory in the field.

Severe outbreaks of whiptail in cauliflower [ibid., xxiii, p. 39] can be controlled by the application of about 1½ to 2 tons of agricultural lime to the soil.

Mottle leaf of citrus due to zinc deficiency [ibid., xvii, p. 170] is particularly common in the northern irrigation districts of Victoria. The most satisfactory way of controlling the disease is by spraying the trees with a mixture of 3 lb. zinc sulphate and 1½ lb. hydrated lime with 100 gals. of water.

Psorosis of citrus [ibid., xiii, p. 300] is stated to be rare in Victoria, but there are a few affected trees in the Murray irrigation area. Growers are advised to be on the look-out for the disease and to eradicate the affected trees should such be found.

Blackleg of beet (*Phoma betae*) is becoming increasingly serious in Victoria, whereas blackleg of crucifers (*P. lingam*) is now of minor importance. Generally speaking, the damper the district in which the beet seed is produced, the higher is the percentage infected with *P. betae*. The majority of beet seed crops grown in southern Victoria in the 1942–3 season were infected to a varying degree with *P. betae*; when samples of seed from one red beet crop were sown under experimental conditions, up to 80 per cent. of the seedlings were destroyed by the fungus. Although no really effective means of disinfecting beet seed is known at present, treatment with any organic mercury dust will increase the rate of emergence. It is also recommended that a crop rotation of two or three years between beet crops should be practised.

Damping-off of flax seedlings, caused by a species of *Pythium* [cf. ibid., xvi, p. 611], is reported to have occurred to a limited extent in Victoria in the past two

seasons. The disease is favoured by any condition which delays the emergence and early growth of the seedlings, namely, excessive soil moisture, cold weather, deep sowing in heavy, acid soils, and the setting of the surface of the soil after rains. The diseased seedlings show a reddish-tan to brick-red discoloration on the cotyledons or the young roots, both of which rot completely before emergence in severe cases.

WILKINS (W. H.) & HARRIS (G. C. M.). **Investigation into the production of bacteriostatic substances by fungi. Preliminary examination of a second 100 fungal species.**—*Brit. J. exp. Path.*, xxiv, 4, pp. 141–143, 1943.

In further studies on the antibacterial properties of a second 100 fungi [*R.A.M.*, xxii, p. 13], *Penicillium expansum*, *P. gladioli*, and five other *P.* spp. inhibited the growth of all three test organisms, viz., *Bacterium coli*, *Staphylococcus aureus*, and *Pseudomonas pyocyanea*; 14 fungi, including *Phytophthora erythroseptica* and *Sclerotinia minor*, were antagonistic to the two first-named bacteria, and 15 to one only of the three, the remainder giving negative results.

WILKINS (W. H.) & HARRIS (G. C. M.). **Investigation into the production of bacteriostatic substances by fungi. II. A method of estimating the potency and specificity of the substances produced.**—*Ann. appl. Biol.*, xxx, 3, pp. 226–229, 1 pl., 1943.

The following 'zonation' method for estimating the degree of potency and the specificity of bacteriostatic substances produced by fungi, based on the examination of several hundred species over a period of two years [see preceding abstract], has been evolved by the authors and used in the University Department of Botany, Oxford, since 1941. The test is made against *Bacterium coli* and *Staphylococcus aureus* and consists in placing a few drops of the bacteriostatic substance to be tested in a hole cut with a sterile cork borer at the centre of a plate of bacteria-incorporated agar and in measuring the resultant zone of inhibition, which varies in width in proportion to the concentration of the substance. The accuracy of the method was statistically proved with the help of a standard inhibitor (mercuric chloride), and close correlation was established between the new and the standard 'dilution' method.

POUND (F. J.). **Cacao and witches' broom disease (Marasmius perniciosus). Report on a recent visit to the Amazon territory of Peru, September, 1942–February, 1943.**—14 pp., 1 diag., 1 map, Trinidad and Tobago, A. L. Rhodes, 1943.

This is an expanded account, preceded by a covering statement by R. O. Williams, Acting Director of Agriculture, Trinidad, of F. J. Pound's visit to Peru in connexion with the breeding of cacao for resistance to witches' broom (*Marasmius perniciosus*), a preliminary note on which has already appeared [*R.A.M.*, xxii, p. 346]. As a result of this survey, in conjunction with the records from previous expeditions, the present distribution of the disease may be defined as follows. On the eastern side of the Andes it occurs along the Rio Urubamba in Peru to beyond the borders of Bolivia, the Rios Napo, Putumayo, Caqueta, and Ortegaza, and the Orinoco down to the delta. The Eastern and Western Cordilleras appear to form an effective barrier to the ingress of the pathogen into the main cacao-producing regions of Colombia and Venezuela. The infected zone thus comprises the coastal plain of Ecuador, the Amazon and Orinoco River systems, and the Guianas between them. In the light of present knowledge, it seems more likely that the original focus of witches' broom was in the Amazon Valley, possibly in the vicinity of Iquitos, rather than in Surinam, as formerly supposed.

While *M. perniciosus* is absent at elevations above 1,000 ft. in the Northern Range hillsides of Trinidad, at a latitude of 11° north of the Equator and with a

rainfall of 100 in., it occurs in the Atlantic foothills of the Peruvian Andes on the Equator at 2,000 ft. with considerably heavier precipitation. Under drier conditions (30 to 40 in. rainfall per annum), the disease does not develop at 3,000 ft., while at 11° north it is unimportant or non-existent at 1,000 ft. notwithstanding high humidity. Exposure is another factor that appears to affect the expression of resistance to witches' broom. In Ecuador, for example, the contrasts in disease incidence were sharper under illumination than in the shade, i.e., more trees were resistant than would be expected and some more heavily infected. In general, there are more trees in the lightly infected class under exposed than under shaded conditions. At the same time, all the large trees located with only one or two brooms were growing partially or entirely in the shade, thereby arousing a suspicion that on a more exposed site they might have shown no trace of the disease. For this reason only a few very well-developed disease-free exposed trees were included in the selection list. It would appear from these and other considerations that cacao trees possessing a genetic basis for resistance may, by cultivation in areas where heavy infection is improbable, acquire complete freedom from witches' broom.

It would be unsafe to conclude that the selected South American material is necessarily suitable for general planting under the different conditions prevailing in Trinidad, and a propagating unit has been constructed at Marper Estate, on the Island, for the application of stringent tests to determine the capacity for resistance, yield, and quality of the product of the vegetative progeny. Efforts are further being made to test promising clones under a variety of conditions in Trinidad, and before leaving Peru the writer laid down at Iquitos a simple demonstration trial of the 32 trees selected during the 1942 expedition. It is hoped by this means to provide sufficient material within a few years for wholesale distribution to estates on which the soil and other conditions are adapted to cacao cultivation.

Fischer (G. W.) & Holton (C. S.). **Studies of the susceptibility of forage grasses to cereal smut fungi. IV. Cross-inoculation experiments with Urocystis tritici, U. occulta, and U. agropyri.**—*Phytopathology*, xxxiii, 10, pp. 910–921, 1943.

This is an expanded, fully tabulated account of the writers' cross-inoculation tests at the Washington Agricultural Experiment Station with spores of the wheat, rye, and grass smuts (*Urocystis tritici*, *U. occulta*, and *U. agropyri*) on a number of forage grasses, a preliminary note on the earlier series of which has already appeared [*R.A.M.*, xxi, p. 293], supplemented by more recent information on the reactions to the same pathogens of certain wheat and rye varieties and cereal × grass hybrids.

U. tritici was more or less pathogenic to *Agropyron caninum*, *A. dasystachyum*, *A. desertorum*, *A. inerme*, *A. repens*, *A. semicostatum*, *A. spicatum*, *A. trachycaulum*, *Elymus canadensis*, *E. glaucus*, *E. triticoides*, and *Hordeum jubatum* var. *caespitosum*, while *A. caninum*, *A. inerme*, *E. canadensis*, and *E. triticoides* were susceptible in varying degrees to *U. occulta*.

U. agropyri is believed to consist of a number of physiologic races, three of which were represented in the four collections used in the tests and designated C-I, C-H, and C-F from *A. trachycaulum*, *H. jubatum*, and *A. repens*, respectively. An anomalous position was occupied by the collection C-9 from *Poa ampla*, which failed to infect any of the 28 species of grasses inoculated, probably owing to the absence of germinable spores.

Kanred × Hard Federation C.I. 10092 wheat contracted slight infection by *U. agropyri* in one out of three tests, and the smut thus produced was readily propagated on the same variety. *U. occulta* did not attack wheat nor *U. tritici* rye, the latter being also apparently immune from *U. agropyri*.

The outcome of these trials is considered to indicate a genetic connexion between *U. agropyri* and *U. tritici*, in which *U. occulta* may likewise be concerned. *U. tritici*

is thought to have arisen in the form of strains of *U. agropyri* capable of attacking wheat [ibid., xxii, p. 245], in which case the outbreaks of wheat flag smut in the United States would be traceable to the widespread indigenous disease on grasses and not to introduced material. The author therefore proposes the consolidation of the flag smuts of wheat and grasses under the binomial having priority, i.e., *U. agropyri*.

Noll (A.). **Über eine durch Gelbrostinfektion in resistenten Getreidesorten und durch andere Ursachen hervorgerufene wundgummiartige Substanz.** [On a wound-gum-like substance produced in resistant cereal varieties through yellow rust infection and other causes.]—*Zbl. Bakt.*, Abt. 2, cv, 23–24, pp. 448–459, 1 fig., 1943.

At the Gliesmarode (Brunswick) branch of the Biological Institute the writer detected the presence in the tissues of immune and resistant wheat (Rouge prolifique barbu, Spalding's Prolific, and Chinese 166) and barley (Heil's Franken and Bethge's III) varieties inoculated with *Puccinia glumarum* of a substance characterized by insolubility in strong acids and alkalies, destructibility by chlorine-containing oxidizers, and weak reaction to aniline dyes, in contrast to the rest of the tissue, these relationships being reversed, however, by a preliminary treatment with potash lye and cotton blue [*R.A.M.*, xxii, p. 409]. The results of small-scale greenhouse experiments indicated the possibility of predicting the mature reaction of a given variety to yellow rust by the distribution in inoculated seedling tissues of the nearly colourless to dirty yellow, later brown gum. Thus, in immune varieties, it is usually present only in and immediately surrounding the guard cells of the leaf and one to a few mesophyll cells below the stomata, whereas in the resistant it is deposited, following the course of the hyphae, not only in the tissues adjoining the infected stomata but in more or less extensive areas of the leaf, especially the mesophyll. Even in highly susceptible varieties the gum develops in the stomatal apertures, the sole exceptions being such extreme cases as the pure IV type of infection represented by Michigan Amber inoculated with physiologic race 1. A remarkable feature of the substance is the rapidity of its formation, its presence in the stomata often being discernible before the fungus has even initiated the first step towards infection, i.e., the production of vesicles beneath the stomata, and 24 hours earlier than any trace of mycelium could be expected to develop under favourable conditions.

Further experiments with *P. triticina*, *Helminthosporium gramineum*, *Melampsora lini*, *Erysiphe graminis*, and other fungi and bacteria yielded similar results to the foregoing as regards the development of the gum, which is interpreted, on the basis of its chemical reactions, as wound gum. Hence it is apparently non-specific.

Stakman (E. C.), Loegering (W. Q.), Cassell (R. C.), & Hines (L.). **Population trends of physiologic races of Puccinia graminis tritici in the United States for the period 1930 to 1941.**—*Phytopathology*, xxxiii, 10, pp. 884–898, 3 figs., 3 graphs, 1943.

Some of the information presented in this 12-year survey of population trends of physiologic races of *Puccinia graminis tritici* in the United States has already been noticed from other sources [*R.A.M.*, xi, p. 436; xvii, p. 381, *et passim*]. During the period under review, 1930 to 1941 inclusive, five races have ranked first in prevalence and amount, in one or more years, viz., 36, 38, 49, 56, and 17, of which the first three were of major importance in the first half of the decade 1930 to 1939, while 56 took their place from 1934 to 1940, when it began to decline and race 17 assumed an upward trend: at the present time, 56 and 17 appear to constitute at least 90 per cent. of the inoculum in the Mississippi Basin. The phenomenal increase in incidence of race 56 from 1934 onwards has led to the exclusion of Ceres from the

resistant class of wheat varieties [ibid., xxii, p. 189], and its replacement by Thatcher, which is resistant to 56 and immune from 17.

The population shifts of physiologic races show the need for replication in time and space in varietal tests for stem rust resistance, unless the varieties are exposed to artificial epidemics by inoculating with all races likely to occur in the region for which the variety is intended. The importance of barberries in the production and perpetuation of physiologic races of *P.g. tritici* has been discussed in connexion with earlier studies [ibid., xiii, p. 753] and the report of the physiologic race survey for 1940 (U.S. Dep. Agric., B.E.P.Q., E-522-A, 18 pp., 1942—mimeographed). In this report it is stated that during 1940 (chosen as a representative year), races 9, 10, 14, 24, 40, 55, 69, 77, 79, 83, 117, 121, 126, 140, 146, and 147 were isolated exclusively from barberries or rusted wheat in their vicinity. Barberries may definitely be held responsible for the occurrence of these races in 1940, since they were absent from Mexico, Texas, and Oklahoma, whence uredospores can be disseminated in the spring. Race 56 was recognized in the barberry area at least five years before it appeared in Texas and became established in northern Mexico. The data show the paramount importance of barberry eradication in reducing the number of races and preventing the production of new ones.

Changes in the proportion of the individual races may be gradual or sudden, and accordingly the reactions of wheat varieties in the field tend to vary directly with their changes, although the additive effects of several races and environmental conditions may be modifying factors. Little definite information is available regarding the causes of the changes in the prevalence of races.

Garrett (S. D.). **Competition for nitrogen between the take-all fungus and the roots of crop plants.**—*Nature, Lond.*, clii, 3858, pp. 417–418, 1943.

Eight weeks after pieces of wheat straw infected by *Ophiobolus graminis* had been buried in fallow soil and in soil under trefoil [*Medicago lupulina*], mustard, and oats (250 pieces 1½ in. long to each lot, in boxes of soil), the percentage of straws containing viable mycelium was, respectively, 68, 18, 17, and 4 per cent. It appears, therefore, likely that *O. graminis* will disappear more rapidly from soil under a non-susceptible crop than from soil kept fallow. This may explain why barley, though susceptible and liable to be severely attacked in the second or third consecutive crop, has not been found to be affected when undersown with trefoil, which makes a luxuriant growth in late summer and autumn after the barley has been cut, and is then ploughed in as a preparation for the next barley crop. The author suggests that the active growth of the trefoil after the barley has been harvested keeps the available nitrogen content of the soil at a very low level. This adversely affects the longevity of the fungus, which becomes unable to survive until the new barley crop is sown.

Diachun (S.), Johnson (E. M.), & Valleau (W. D.). **Colonies of Bacterium tabacum on roots of Wheat and several grasses.**—Abs. in *J. Bact.*, xlv, 6, p. 577, 1943.

Colonies of *Bacterium tabacum* [*Pseudomonas tabaca*] developed on sterile wheat seedling roots within two days of their immersion in an aqueous suspension containing some 2,000,000 bacteria per ml. Definite colonies were present on the surface of the root epidermis of 85 out of 96 inoculated plants, which appeared to sustain no appreciable injury. Severe wildfire followed the inoculation of tobacco leaves with aqueous suspensions of the infected wheat roots. Kentucky bluegrass [*Poa pratensis*] roots were more resistant than wheat to infection by *P. tabaca*, only an occasional plant contracting the disease when the inoculum contained 2,000,000 bacteria per ml.; however, an increase in the concentration up to 20,000,000 resulted in an incidence of 20 to 40 per cent. Rye grass [*Lolium*

perenne], timothy [*Phleum pratense*], and redtop [*Agrostis vulgaris*] were intermediate in their reactions to *P. tabaca*.

Stakman (E. C.), Kernkamp (M. F.), King (T. H.), & Martin (W. J.). **Genetic factors for mutability and mutant characters in Ustilago zeae.**—*Amer. J. Bot.*, xxx, 1, pp. 37–48, 5 figs., 1 diag., 1943.

At the Minnesota Agricultural Experiment Station a cross was made between two haploid lines of maize smut (*Ustilago zeae*) [*R.A.M.*, xxiii, p. 13 and next abstract] with several contrasting cultural characters. The four primary sporidia isolated from the promycelium of a single resultant chlamydospore gave rise to four F_1 monosporidial lines presenting conclusive evidence of 2 : 2 segregation for sex, colour, growth type, topography, and tendency to sectoring. A thorough study was made of cultures of the 25 sporidia isolated from each of these lines, with the exception of one from line 4 which died, and it was found that all lines derived from the monosporidial lines 1 and 2 were alike, as also were those originating from 3 and 4. This result is interpreted as denoting the completion of segregation before the abjointing of the primary sporidia and the constitution by the progeny of single sporidia of a clone or biotype in the absence of mutation.

Each F_1 line was grown on potato dextrose agar in duplicate flasks and no sector variants developed in about 100 colonies of lines proceeding from sporidia 1 and 2, whereas in those arising from 3 and 4 there were some 360 mutants in a comparable number of colonies. A study of the F_2 progeny of a cross between two F_1 lines with contrasting attributes indicated clear segregation for several of these, including sex and mutability, although all lines obtained from the promycelia of three of the eleven chlamydospores were diploid. The absence of reduction division in these individuals was later shown to be associated with a tendency to autolysis of the promycelia conferred by some factor or factors inherent in certain constant haploid lines.

The F_2 offspring comprised some lines remaining constant under all normal conditions and others varying in different degrees. Constant × constant and variable × variable crosses were made among these lines, and segregation for the two characters occurred in the F_3, with a tendency for the former to produce constant and the latter variable segregates: one constant × constant cross yielded all constant progeny. All F_5 segregates from a series of variable × variable crosses were variable, as also were the 34 proceeding from a back-cross between an F_5 and an F_4 variable line. The constant × constant series presented some difficulty connected with the factor for lysis in most of the lines involved, but this was eventually overcome and virtually complete constancy attained in the F_8.

Some lines are strictly sporidial, others strictly mycelial, and others sporidial-mycelial; the change from sporidial to mycelial is not to be confused with the production of true variants. The heritable basis of mutability in *U. zeae* is apparent from the results of crosses of mutants and their parents with the same lines of opposite sex, evidence to this effect being adduced in connexion with a white mutant, 1OK2-1, that arose in a brownish colony of a monosporidial, unisexual line. All crosses between this mutant and its white derivatives gave rise to some white segregates, which never appeared, on the other hand, among the offspring of crosses involving the parent line. Only two of the 83 white or nearly white lines proceeding from the original white mutant appeared to be culturally identical under comparable conditions. No combination of the numerous white lines derived from 1OK2-1 produced chlamydospores, though some gave rise to large galls on maize plants, indicating that the factors for sex and pathogenicity are not the same, and that the parasitic dicaryophase is not necessarily succeeded by the diplophase.

An indefinite number of biotypes may be obtained by the isolation of mutants

from sector variants in mutable lines. Mutation may occur in respect of almost every observable character, the mutants differing from their progenitors and among themselves very decidedly or in practically imperceptible gradations. The combinations arising from crosses between monosporidial lines also yield innumerable biotypes of *U. zeae*. In the writers' extensive series of hybridizations, all the haploid segregates of a cross were not infrequently observed to be different, while in the progeny of many crosses even the parental lines were not represented.

At least 5,000 readily distinguishable biotypes arose from two haploid sporidia of opposite sex and contrasting characters, and it is concluded that the maize smut comprises an unlimited number of such variants, which are, moreover, continually being produced as a result of mutation and of recombinations developing from inter-biotypic hybridization. The latter process is of frequent occurrence, and in some of the resultant biotypes mutation is almost incredibly common. The species consequently presents an extraordinary range of diversity. Equally remarkable, however, is the homogeneity of the chlamydospores, regardless of the particular cross producing them or the time and place of their development in nature.

Stakman (E. C.), Kernkamp (M. F.), Martin (W. J.), & King (T. H.). **The inheritance of a white mutant character in Ustilago zeae.**—*Phytopathology*, xxxiii, 10, pp. 943–949, 2 figs., 1943.

This is an abridged account of the authors' studies on the inheritance of a white mutant character in maize smut (*Ustilago zeae*), fuller details of which were published elsewhere [see preceding abstract]. This paper emphasizes the significance of the failure to obtain functional chlamydospores from crosses between the white offspring of the original white mutant, which is interpreted as an indication of the existence of multiple factors for sex. It is suggested that the nuclei of certain white lines possess the necessary factors for attraction and association enabling them to produce the dicaryophase, but not those leading to complete sexual fusion. This and other evidence of a similar nature points to gradations in the degree of 'maleness' and 'femaleness', in so far as such terms are applicable to an organism like *U. zeae*, which appears to be entirely isogamous.

Fawcett (H. S.) & Bitancourt (A. A.). **Comparative symptomatology of psorosis varieties on Citrus in California.**—*Phytopathology*, xxxiii, 10, pp. 837–864, 14 figs., 1943.

The term 'psorosis' is extended to cover a group of similar disorders of citrus, previously believed to be of independent origin but now attributed to different manifestations of a single virus *Citrivir psorosis*, viz., psorosis A and B [*R.A.M.*, xx, p. 175], blind-pocket psorosis, concave-gum psorosis [ibid., xx, p. 360], and crinkly-leaf psorosis (Color handbook of Citrus diseases, 1941) [ibid., xxii, p. 131]. A common feature of all these variants of psorosis is a white to yellowish, mosaic-like flecking of the veinal region or cleared bands along the veins and veinlets of the young leaves, accompanied by fundamentally similar changes in the wood giving rise to such primary symptoms.

Psorosis A and B (*C. psorosis* vars. *vulgare* and *annulatum*, respectively) cause, besides the above-mentioned young-leaf symptoms, (*a*) bark lesions, characterized either by a dry irregular flaking-off of the outer cortex, or by dry, erumpent pustules; and (*b*) two kinds of wood lesions [see next abstract], namely, primary infections near the cambium, consisting of layers of gum between layers of wood directly beneath the bark lesions, and secondary damage in the form of discoloured wood, mainly further inwards, these and the contiguous areas of externally healthy wood being devoid of starch and impermeable to the passage of water. Psorosis B differs from A in the production of more rapidly developing and more continuous

areas of cortical scaling, of larger numbers of twig lesions, and of ringed spots on the mature foliage and fruit.

Concave-gum psorosis (*C. psorosis* var. *concavum*) [cf. ibid., xxii, p. 384] induces the formation of cavities due to the inhibition or retardation of wood growth in restricted areas of the trunk or large branches. The gum layers accumulating in the wood in this form of the disease are similar to those of A and B, but more localized.

Blind-pocket psorosis (*C. psorosis* var. *alveatum*) may usually be recognized by the appearance of trough-like straight- or convex-sided depressions in the trunk or limbs, associated with the inhibition of wood growth within even narrower limits than in the case of concave gum. Below the lesion, the loose wood parenchyma is usually impregnated with a waxy or gummy substance.

Broadly speaking, the primary lesions in the wood caused by the four variants of psorosis under discussion are similar, except for the extent of the resultant alterations, which are intensive but narrowly localized in blind pocket, somewhat more diffuse in concave gum, and widespread in A and B, sometimes even involving girdling of the trunk and limbs.

Crinkly-leaf psorosis, which chiefly affects lemons, causes a warping and pocketing of fully-grown leaves besides the young-leaf symptoms. The fruits of affected trees tend to be rough, coarse, and irregularly bumpy. Distinctive bark or wood symptoms are absent. Another disturbance principally affecting lemons is infectious variegation, characterized by irregular, chlorotic areas on the leaf blade and provisionally regarded as an occasional feature of the crinkly-leaf complex, both types usually being found in conjunction with psorosis A.

Corky bark, of which there are five types, namely, necrotic cavity, crumbly gum, banded, circular spot, and tattoo-netted, and knobby bark may also be virus effects related to the foregoing: all were observed on oranges.

Bitancourt (A. A.), Fawcett (H. S.), & Wallace (J. M.). **The relations of wood alterations in psorosis of Citrus to tree deterioration.**—*Phytopathology*, xxxiii, 10, pp. 865–883, 9 figs., 1943.

This is an expanded account of the writers' experiments to determine the relation of the wood alterations in citrus psorosis [see preceding abstract] to tree decline, a preliminary note on which has already appeared [*R.A.M.*, xxii, p. 62].

Hendrickx (F.). **Colletotrichum ou Antestia?** [*Colletotrichum* or *Antestia*?].—*Publ. Inst. nat. Étude agron. Congo belge*, Sér. sci., 26, pp. 10–16, 2 figs., 1942.

The examination during the season of 1938–9 of thousands of coffee berries convinced the author that much of the damage attributed to infestation by *Antestia* sp. in the Belgian Congo is in reality due to *Glomerella cingulata* [*R.A.M.*, xix, p. 330], mainly in its conidial stage (*Colletotrichum coffeanum*). The perfect phase has not yet been observed under natural conditions in the Kivu, though it developed in pure culture; its part in the perpetuation of infection is in any case believed to be subordinate. Berries attacked at an early age fail to develop and are totally unmarketable, being converted into a blackish mass. The spots on the green berries are sunken, brownish-yellow, darker in the centre than round the periphery, later turning dark brown, expanding, and becoming covered with the black pycnidia of the fungus, from which masses of unicellular, hyaline, oblong to slightly reniform conidia are liberated. The lesions on the ripening fruits are uniformly black, depressed, and sticky to the touch; at this stage the fructifications raise minute vesicles on the epidermis, which they ultimately rupture. Humidity seems to be the most important meteorological factor affecting the development of *G. cingulata*, renewed outbreaks of which appear to be invariably associated with showers of rain.

Of the three agents of stigmatomycosis entering the berries through the punctures

by the Pentatomid *Antestia*, namely, *Nematospora coryli*, *Ashbya* [*N.*] *gossypii*, and *Spermophthora gossypii*, only the first-named has so far been observed locally.

In order to ascertain the extent of damage to the crop caused by a late attack of *G. cingulata*, five batches, each consisting of 100 ripening berries bearing the fruit bodies of the fungus, were chosen at random from the plots of the Mulungu plantation and the 965 beans they contained divided into two groups, floating (due to partial or total disorganization of the endosperm) and normal, representing 13·6 and 86·4 per cent., respectively, of the total number. The normal group comprised 6·37 per cent. *Antestia* infestation, manifested by the presence of *N. coryli* at the sites of the punctures. No symptoms were apparent on 80·65 per cent. of the normal or on 69·70 per cent. of the total number of beans attacked by *G. cingulata* at approaching maturity, and in no case was the mycelium of the fungus detected in the interior of the spermoderm. Hence it is concluded that late invasion by *G. cingulata* is incapable of inducing destruction of the seed, a fact which in no way minimizes the risk of serious losses from early infection of the still milky endosperm by the parasite.

Arny (A. C.). **Flax varieties registered, I.**—*J. Amer. Soc. Agron.*, xxxv, 9, pp. 823–824, 1943.

Particulars are given of the first two flax varieties to be approved for registration in the United States, Biwing Reg. No. 1 and Redson Reg. No. 2, which are selections from the cross Bison × Redwing made in 1929 at University Farm, St. Paul, Minnesota. The wilt (*Fusarium lini*) percentages of Biwing and Redson were 9 and 3, respectively, compared with 23 and 9 for Bison and Redwing, respectively. The reactions of the two new varieties to rust (*Melampsora lini*) were classified as moderate− and moderate ⊦, respectively, those of Redwing and Bison being moderate− and heavy−, respectively, while both the selections were placed in the light± category for reaction to 'pasmo' (*Phlyctaena linicola* [*sphaerella linorum*]), the incidence of which in Redwing was moderate and in Bison light.

Robinson (B. B.). **Greenhouse seed treatment studies on Hemp.**—*J. Amer. Soc. Agron.*, xxxv, 10, pp. 910–914, 1943.

The Bureau of Plant Industry having been requested to determine the benefits, if any, of seed treatment of hemp, an important war-time crop which has hitherto been little injured by disease, co-operative greenhouse trials were conducted in Illinois, Wisconsin, South Carolina, Mississippi, and Maryland, the choice of plant-protectives being left to the discretion of the local organizers. Generally speaking, emergence was improved by the ten dusts used at the prescribed concentrations, though some damage was caused in Wisconsin by ceresan. The price of hemp seed ranges from $5 to over $10 per bush. of 44 lb., and the recommended rate of sowing is 55 lb. per acre, so that for such valuable seed precautionary treatment may be well worth while.

Massey (L. M.). **The black-spot war situation. Tests with fungicides for black-spot.**—*Amer. Rose Annu., 1943*, pp. 141–154, 1943.

The results of trials in the control of rose black spot [*Diplocarpon rosae*] at the New York (Cornell) Agricultural Experiment Station in 1941–2 were reasonably consistent and in general agreement with those of previous years [*R.A.M.*, xviii, p. 598]. Both copper- and sulphur-containing dusts and sprays gave adequate control. To cite some figures, in 1941 the mean number of diseased leaflets was reduced from 346 in the controls to 0·0, 0·0, 1·3, and 4·7 by 325-mesh sulphur with 3·4 per cent. copper dust, Koppers' flotation sulphur dust, 'mike' sulphur dust with 3·4 per cent. copper, and red copper oxide dust, respectively, while in 1942 the best results were given by micronized sulphur with 6·8 per cent. copper (4·5

spotted leaflets compared with 80·4 in the checks). Fermate, used in the latter year only, reduced the number of infected leaflets to 16·8. In mixtures of copper- and sulphur-containing materials it is advisable to limit the former component to 3·4 per cent. in view of the risk of burning.

Baker (K. F.). **Sphaerotheca humuli var. fuliginea on Delphinium in California.**—*Phytopathology*, xxxiii, 9, pp. 832–834, 1943.

Sphaerotheca humuli var. *fuliginea* appears from an examination of herbarium specimens to have been present on cultivated and wild species of *Delphinium* in California for at least 19 years, though this is the first published record of its occurrence on the host in question or other Ranunculaceae in North America. The fungus has, however, been reported on *D. grandiflorum*, *Paeonia anomala*, *Thalictrum minus*, and *T. simplex* in the U.S.S.R., *T. alpinum* in Norway and Sweden, and *Trollius europaeus* in Italy [*R.A.M.*, xiii, p. 127]. The perithecia of the specimens collected on *D. amabile* at Los Angeles measured 60 to 89 (average 76·3) μ in diameter, with conspicuous wall cells, 13 to 28 (21·3) μ in width, the asci 46 to 88 by 43 to 71 (63·7 by 56·8) μ, and the ascospores 13 to 26 by 13 to 18 (18·1 by 14·5) μ. *S. humuli* var. *fuliginea* is readily distinguishable from *Erysiphe polygoni* on the same hosts by its large, convex, comparatively pale perithecial wall cells, with deeply indented sutures, sparse mycelial development, and concatenate conidia.

Rossetti (Victoria). **Podridão preta das Orquideas.** [Black rot of Orchids.]—*Biológico*, ix, 8, pp. 201–205, 3 figs., 1943.

Species of *Laelia* in the orchid plantings of Buenos Aires have recently been severely damaged by a Phycomycete, the vegetative growth habit of which in pure culture on potato dextrose agar is reminiscent in some respects of *Phytophthora parasitica* and in others of a *Pythium*. A closer identification is impracticable pending the development of fructifications. The disease is characterized by a dark brown, flaccid rot of the pseudo-bulb tissues, which are subsequently invaded and still further disorganized by saprophytic fungi and bacteria, and a sharply defined, black discoloration of the leaves, forming a striking contrast to the brilliant green of the normal foliage. The infected leaves fall at the slightest contact, and the fungus continues to develop until they are completely blackened; the pseudo-bulbs remain attached to the rhizome and ultimately become mummified. Inoculation experiments on the wounded pseudo-bulbs and leaves of *L. purpurea* and *L. crispa* gave positive results, the pathogen being reisolated from the infected tissues. A serious feature of the disease is its rapid spread, one grower, for instance, having lost 300 plants in 20 days. A suspected plant should therefore immediately be removed, while another precautionary measure (for large-scale use only) consists in the excision of the rhizomes and transplantation to a fresh, healthy site, where the plants must be kept dry, supplied with ample ventilation, and gradually exposed to the sun.

Wolf (F. A.). **The perfect stage of Cercospora sordida.**—*Mycologia*, xxxv, 5, pp. 503–509, 1 fig., 1943.

The author observed on decaying leaves of trumpet creeper (*Tecoma radicans*) the perithecial stage of *Cercospora sordida*, which he describes under the name *Mycosphaerella tecomae* n.sp. Cultures from ascospores were identical with those from conidia and yielded *Cercospora* conidia, which were also abundantly produced from the ostiolar region of the perithecia of *M. tecomae*.

Greenall (A. F.). **Low germination of perennial Ryegrass seed in South Otago.**—*N. Z. J. Agric.*, lxvii, 2, pp. 79–81, 1943.

Considerable losses were experienced during the past two seasons in South Otago, New Zealand, as a result of low germination in rye grass [*Lolium perenne* and *L. multiflorum*] due to the blind seed fungus [*Phialea mucosa*: *R.A.M.*, xxii, p. 171]. It has become increasingly apparent that climate, and particularly humidity, exercise a great influence on the severity of attack. In tests carried out by the Seed Testing Station, Palmerston North, a correlation was found to exist between the percentage of immature uninfected seed and the percentage of germinating seed in the machine-dressed sample. Thus, when a sample contained 86 per cent. uninfected seed the germination of the machine-dressed seed was 66 per cent., while when there was only from 5 to 17 per cent. uninfected seed, the germination of the machine-dressed seed was only 12 per cent. It is suggested that a test should be made on all fields of rye grass prior to their being cut in order to ascertain the probable germination. From the results of this test, growers will be able to decide whether the expected germination warrants threshing and machine-dressing.

Sprague (M. A.) & Graber (L. F.). **Ice sheet injury to Alfalfa.** *J. Amer. Soc. Agron.*, xxxv, 10, pp. 881–894, 2 figs., 1 graph, 1943.

As a result of ice sheet formation following sleet storms in south-eastern Wisconsin in February, 1937, the lucerne stands on 237,000 acres (about one-fifth of the total area under the crop in the State) were so severely thinned and injured as to be of no commercial value for hay. A full report is given of storage trials providing conclusive evidence that the damage was due to the inadequate diffusion of carbon dioxide, increasing concentrations and pressures of which induced a toxic condition in the plants. Dormant cold-hardened plants frozen and maintained in blocks of ice were weakened after 12 and dead within 20 to 26 days. Circulating water permitted complete survival and vigorous growth after 60 days of storage, while plants confined in still water were enfeebled after 30 days and dead after 60 at 1° C. Circulating atmospheres of 25 or 50 per cent. carbon dioxide in air caused some weakening at 21, 27, and 35 days and were lethal at 54, while plants stored in 0, 5, and 10 per cent. mixtures all showed fair survival and growth after 54 days.

Padwick (G. W.) & Azmatullah (M.). **Claviceps purpurea (Fr.) Tul. and a new species from Simla.**—*Curr. Sci.*, xii, 9, p. 257, 1943.

Claviceps viridis Padwick & Azmatullah n.sp. is the name applied to an ergot fungus the sclerotia of which were collected immediately below the grass *Oplismenus compositus* at Simla in August, 1942, about a fortnight after the detection of *C. purpurea* on *Brachypodium sylvaticum*, already recorded as the host of a *C.* sp. in 1941 [*R.A.M.*, xxi, p. 206]. The new species is characterized by green or greenish-black, cylindrical, curved sclerotia, 6·4 by 1·3 (4 to 10 by 1 to 1·5) mm.; yellowish-green, tuberculate capitula, 1 to 1·6 mm. in diameter, borne on yellow stipes up to 4·2 cm. in length; perithecia 280 to 351 by 170 to 229 (322 by 203) μ; ovate, cylindrical asci with rounded apices and tapering bases, 148 to 242 by 2 to 3·1 (178 by 2·6) μ; and ascospores 119 to 188 (145) μ. The conidia are hyaline or pale green, globose or cylindrical, straight or curved, and measure 4·2 to 18·9 by 3·4 to 4·6 (8·4 by 3·8) μ. The fungus was cultured on potato dextrose agar, on which it slowly formed profusely convoluted, greenish-yellow, later darker green colonies, consisting largely of masses of conidia, somewhat smaller than those developing in nature, viz., 3·3 to 12·6 by 1·6 to 3·8 (9·8 by 2·4) μ.

KEITT (G. W.), LANGFORD (M. H.), & SHAY (J. R.). **Venturia inaequalis (Cke.) Wint. II. Genetic studies on pathogenicity and certain mutant characters.**—*Amer. J. Bot.*, xxx, 7, pp. 491–500, 3 pl., 1943.

Continuing their earlier investigations [*R.A.M.*, xxi, p. 208] on the inheritance of pathogenicity of certain mutant characters in *Venturia inaequalis*, using mono-ascosporic lines freshly isolated from perithecia occurring in nature, the authors found only two types of pathogenic reaction to greenhouse inoculations of potted apple trees, viz., lesion, in which typical sporulating lesions were produced, and fleck, in which yellowish flecks (mostly without sporulation, occasionally with scanty sporulation) developed. The two mutant characters studied, 'tan' and 'non-conidial', arise *in vitro* in sectors of cultures. The former differed from normal in its tan colour in culture and its reduced conidial production; it suppressed all macroscopic expression of pathogenicity, lines carrying 'tan' inciting neither lesions nor flecks. The 'non-conidial' differed from normal in producing no conidia (though some lines produced them very sparsely), and in the reduced diameter of the hyphae in cultures *in vitro*; it suppressed all macroscopic expression of pathogenicity in all apple varieties studied except McIntosh, in which the lesion reaction was modified to fleck.

The results were as follows. Lesion × lesion, fleck × fleck, and lesion × fleck crosses between mono-ascosporic lines which had shown no perceptible change in culture ('normal') produced asci with the normal number of spores. In a given apple variety, crosses of lesion × lesion lines gave all eight lines lesion, fleck × fleck, eight lines fleck; lesion × fleck, four lines lesion and four fleck. In all cases, segregation of factors for pathogenicity, as determined by the lesion and the fleck reactions, were in the ratio 1 : 1. Occasionally, 3 : 1 phenotypic ratios occurred, and with some isolate-variety combinations the lesion and fleck reactions merged. This indicates that modifying factors may sometimes operate.

Normal × normal gave asci containing 8 normal lines. Normal × tan gave asci containing 4 lines normal and 4 lines tan. All lines carrying tan were non-infectious. The evidence also showed that mutation to tan entirely suppressed the expression of the factor for pathogenicity. Normal × tan non-conidial gave asci containing the lines that would be expected from a cross involving two characters, viz., tan, non-conidial, tan non-conidial, and normal. Different combinations of characters occurred in the different asci, but in any given ascus the factors for tan and non-conidial, respectively, segregated from their alleles in 1 : 1 ratio. As in the normal × tan cross, all lines carrying tan were non-infectious on all varieties tested. Lines carrying non-conidial without tan were non-infectious on all varieties tested except McIntosh, on which they produced flecks. Other evidence showed that mutation to non-conidial did not occur at the locus of the gene for pathogenicity.

WILKINSON (E. H.). **Perennial canker of Apple trees in England.**—*Gdnrs' Chron.*, Ser. 3, cxiv, 2966, p. 159, 2 figs. (1 on p. 161), 1943.

The fungus causing the die-back and canker of apple branches recently described by the author [*R.A.M.*, xxi, p. 419] has been found to agree perfectly with *Gloeosporium* (*Neofabraea*) *perennans* [ibid., xxii, p. 29]. The spores, taken from cankers in fruits, measure 6 to 21 by 1·5 to 6 μ. Suspended in distilled water and 0·1 per cent. sucrose solution, they readily germinate, and after about 70 hours, small secondary conidia are budded from the growing hyphae and become dispersed in the solutions. In distilled water and 0·1 per cent. sucrose solution they measure, respectively, 3 to 6 by 1·5 (average, 5 by 1·5) μ and 3 to 9 by 1·5 to 3 (average, 5·9 by 1·8) μ.

The disease affects Worcester Pearmain, Bramley's Seedling, Allington Pippin, Laxton's Superb, and Cox's Orange Pippin apples in Cheshire, Cambridgeshire, Worcestershire, and Somersetshire. The only serious outbreak of the canker phase

was that recorded from Worcestershire [ibid., xxi, p. 419], but minor outbreaks have occurred at Cropthorne, in the same county, and at Long Ashton, both developing after the orchards had been summer pruned. Trees not summer-pruned in the Worcestershire orchard were completely free from infection, but four of these pruned in July, 1942, showed most of the cuts infected by the following September.

A pure culture of the fungus, when inoculated into the cut surfaces of apple branches, rapidly produces cankers characterized by a peeling away of the periderm with exposure of the cortical tissues, which turn black. The fruiting bodies appear over the exposed surface of the cortex of the younger branches and protrude through the bark on older branches to produce white, glutinous masses of spores.

Three species of *Gloeosporium* are known to produce apple lenticel rots in Great Britain, viz., *G. album*, *G.* (*N.*) *perennans*, and *G. fructigenum*. The rots due to the first two are identical, but the spores of *G. album* measure 12 to 27 by 3·4 to 5 μ. *G. fructigenum* produces a more rapid rot with greyish-black surface mycelium and glutinous masses of ochraceous-buff to O-orange spores measuring 12 to 31 by 4 to 7·5 μ. Inoculations indicated that *G. album* and *G. fructigenum* are non-parasitic on apple branches.

The substitution of winter for summer pruning and the removal and burning of all affected branches during winter in the Worcestershire orchard where the outbreak was originally observed, appear to have controlled the condition completely.

Watson (R. D.). **Some factors influencing the toxicity of ozone to fungi in cold storage.**—*Refrig. Engng*, xlvi, 2, pp. 103–106, 1 diag., 1943.

In further studies at Cornell University, Ithaca, New York, on the application of ozone to apple storage [*R.A.M.*, xxi, p. 209], the writer determined the influence of certain factors on the toxicity of the chemical to fungi.

In experiments with *Sclerotinia fructicola*, using a modification of Liu's spore germination method [ibid., xx, p. 414], the ozone (produced from pure oxygen by a metal-glass-metal dielectrode commercial ozonizer) was bubbled through conidial suspensions in towers with sintered glass plates, the duration of treatment ranging from ten seconds to 180 minutes and the concentration from 1·4 to 1,400 p.p.m. In general, when the length of the treatment was doubled, 50 per cent. of the conidia were destroyed at about half the ozone concentration originally required. The relationship, concentration of ozone in p.p.m. × time in hours = constant *K*, held fairly well over a limited range, but not at high or low dosages. The minimum *K* value of 0·91 was obtained with a concentration of 14 p.p.m.

A shorter period of exposure (1 to 2 hours) to ozone was required to kill the conidia of *S. fructicola* in drops than in 5 ml. water in a 9-cm. Petri dish (2½ to 3). The spores in water over 2 per cent. potato dextrose agar remained viable longer (over 5½ hours) than those with sugar and water (over 2 hours) or water alone (over half an hour); in the control series up to 99·5 per cent. germination was still occurring after 49 hours. Ozone killed either wet or dry spores of *Macrosporium* [*Stemphylium*] *sarciniforme* on the skin of apples as readily as in water, the germination percentage of the former after 3½ hours' treatment being 6 and the latter after 1½ hours 11. No wet spores of *Sclerotinia fructicola* or *Penicillium expansum* germinated after treatment for 2 to 2½ hours. Temperature fluctuations between 3° and 34° C. were found to exert a very slight influence on the toxicity of ozone to *S. fructicola* spores.

Among the advantages of ozone as a fungicide are the absence of any residue except oxygen; its ability to reach the apples and inhibit mould growth within and throughout the package in places inaccessible to a non-gaseous product; its

oxidizing properties, freeing the room from odours which are readily absorbed by the fruit and may impair its flavour; at the relatively low concentrations normally used in apple storage rooms (0·4 to 2 p.p.m.), there is no risk of deleterious effects on the health of personnel. Drawbacks to the use of ozone include its failure to protect cut or damaged fruit from decay, since it is destroyed by the exposed flesh; limited rate of diffusion at the low dosages used, involving absence of toxicity to moulds or bacteria throughout liquids of considerable depth; and production of local lenticel scald on peaches at 2 and on apples at 10 p.p.m. in the case of protracted treatments. According to Gane (*Rep. Food Invest. Bd*, pp. 126–127, 1935), bananas were injured at 1·5 p.p.m., while oranges withstood a concentration of 40 p.p.m.

Wilson (E. E.) & Scott (C. E.). **Prevention of three Peach diseases by ferric dimethyldithiocarbamate spray.**—*Phytopathology*, xxxiii, 10, pp. 962–963, 1943.

In 1942, ferric dimethyldithiocarbamate (fermate) was tested as a spray for the control of brown rot (*Sclerotinia fructicola*), rust (*Tranzschelia* [*Puccinia*] *pruni-spinosae*), and shot hole (*Coryneum beijerinckii*) [*Clasterosporium carpophilum*] of peaches in the Sacramento Valley, California.

Two applications, 27 and 13 days, respectively, before harvesting were given in the brown rot experiments, the compound being used at the rate of 1 lb. per 100 gals. plus 4 oz. of a wetting agent. In one orchard, on the first day of picking, the incidence of infection in the treated and control blocks was 4 and 11 per cent., respectively; in another 4 and 19 per cent., respectively, the corresponding figure for lime-sulphur, 0·75–100 plus 4 oz. of a wetting agent being 8 per cent.

The numbers of rust lesions developing on the leaves of trees sprayed on 16th October with fermate 1·5–100, the same plus lime 1–100, Bordeaux mixture 10–10 -100, lime-sulphur 4–100, the same 6–100, and untreated were 3, 1, 9, 1, 1, and 18 per leaf, respectively, the corresponding figures for shot hole being 5, 12, 23, 65, 14, and 156 lesions per 100 twigs, respectively.

It is pointed out that in these trials the compounds were not subjected to such a lengthy weathering period as would normally be the case in orchard practice.

Higgins (B. B.), Walton (G. P.), & Skinner (J. J.). **The effect of nitrogen fertilization on cold injury of Peach trees.**—*Bull. Ga Exp. Sta.* 226, 27 pp., 1943.

A fully tabulated account is given of a series of experiments covering the period from 1929 to 1941 to determine the influence of nitrogen fertilizers on cold injury to Elberta peach trees (nursery stock) under Georgia conditions. The most significant reduction of susceptibility was effected by the application of the nitrogenous constituent of the complete fertilizer at the rate of 8 per cent., at which level it closely approximated to a balance with other nutrients for the normal growth of peaches. The protection conferred by an adequate supply of nitrogen on the trees as a whole did not, however, extend to the buds, flowers, or young fruits. During the latter years of the investigation, the trees in the no-fertilizer (control) blocks showed significantly greater susceptibility to cold injury than those receiving phosphate and potash but no nitrogen, indicating the probability that such a reaction may be associated with the deficiency of any element requisite for healthy growth. The enhanced resistance to cold of the trees in the high-nitrogen blocks is tentatively attributed to the presence in the cambial cells of larger amounts of proteins, coupled with smaller vacuoles, to the nature of the proteins in question, or to both factors combined.

Meredith (C. H.). **Mercury compounds applied to Banana plants in the field.**—*Phytopathology*, xxxiii, 9, pp. 835–836, 1943.

In a further series of experiments at the Glenleigh Laboratory, Highgate P.O.,

Jamaica, on the control of banana wilt (*Fusarium oxysporum cubense*) [*R.A.M.*, xxi, p. 340], very promising results were obtained with hortosan potato dip (8 per cent. nitrophenolmercurihydroxide and chlorophenolmercurihydroxide, supplied by Imperial Chemical Industries, Ltd.). In a test in which the chemical was mixed with the soil in plots 2 ft. by 2 ft. near the plants at dosages of 2, 4, and 8 oz. per sq. ft., the total weight of the roots from the three treated plots after about seven months was 83·4 gm., compared with 79·7 gm. for the checks. Five months after the inception of the test, tubes were half-filled with soil from the treated and untreated areas, autoclaved, inoculated with the pathogen, and the growth rate compared. At the end of nine months, the three treatments permitted 1·5, 0, and 0 cm., growth of the fungus, respectively, compared with up to 4 cm. in the control series, while after 11 months the lowest concentration of hortosan was found to be no longer effectual, though the other two gave reduced development of the parasite. In a second trial, the growth of *F. oxysporum cubense* was inhibited for three and two months on acid and neutral soils, respectively, by hortosan at the rate of 1 oz. per stool, applied at the time of planting. At a dosage of 2 oz., the same compound stimulated the growth of the bananas in comparison with those on the control plots. A third experiment, in which the hortosan was sprinkled on the surface of the soil, gave inconsistent results. No injury was produced on the roots either by hortosan (2 oz.) or DuBay, mercurous chloride, and mercuric chloride (1 oz.).

Sen (P. K.), Mallik (P. C.), & Roy (P. K.). **Toxic effect of gases on plants.**—*Sci. & Cult.*, ix, 2, pp. 87–88, 1943.

A tabulated account is given of studies carried out at the Fruit Research Station, Sabour, India, to determine the relative toxicity of three constituent gases of coal smoke, viz., sulphur dioxide, ethylene, and carbon monoxide in relation to black tip of mango [*R.A.M.*, xx, p. 313]. Pure sulphur dioxide rapidly bleaches and kills the fruit, while at concentrations from 0·5 to 10 per cent., pinkish to brick-red and finally blackish spots develop round the lenticels, the injury increasing in proportion to the strength of the gas and length of exposure. Of interest are the divergent effects of continuous and intermittent exposure, the former inducing toxic symptoms in three hours, whereas the operation of the latter for one hour in the morning (8 to 9) and evening (5 to 6) daily was without influence, even when extending over a total period of nine hours. The atmosphere surrounding the experimental trees was found to contain 0·0067 to 0·049 per cent. sulphur dioxide, as against only 0·000196 to 0·000986 per cent. in the fresh air.

In contrast to sulphur dioxide, the toxicity of ethylene reached a maximum at the lowest concentration used (1 per cent.), which induced yellowing and a deep brown to black spotting of the skin, followed by softening and dropping of the fruits. Dilute carbon monoxide exerted no ill effects, but protracted exposure to the pure gas induced pallor of the skin.

The most resistant of the experimental varieties was Champakelwa.

Scott (C. E.), Thomas (H. Earl), & Thomas (H. E.). **Boron deficiency in the Olive.**—*Phytopathology*, xxxiii, 10, pp. 933–942, 2 figs., 1943.

An olive disease in California characterized by deep pitting and shrivelling of the fruits, chlorosis of the leaf tips, a bunchy growth habit followed by die-back of the branches, and cortical protuberances, 5 to 10 mm. in length and raised 2 mm. above the level of the surrounding bark, responded favourably to branch injections, soil treatment, and spraying with boron compounds, the last-named method, however, producing only transitory effects in severe cases. Boric acid mixed with diatomaceous earth (celite) was introduced into the branches, through holes 2 in. or more in depth, by means of a 'gun' similar to that used in the treatment of lime-induced chlorosis [*R.A.M.*, x, p. 677] at dosages of ½ to 2 'shots' per hole.

A borax spray (2 to 8 lb. per 100 gals.) was applied at 400 lb. pressure, with the addition of a proprietary detergent (dreft) to the June applications to facilitate leaf-wetting. Soil treatments were mostly made broadcast in irrigation furrows. In one district, Butte County, large trees were benefited by less than ½ lb. borax per tree applied by the last-named method, but about 1 lb. appears to be required for a complete cure. Observations and tests on boron deficiency in other crops in California are briefly described.

Kramer (M.) & De Andrade (A. C.). **Estudos sôbre adesivos da calda bordaleza.** [Studies on adhesives for Bordeaux mixture.]—*Biológico*, ix, 9, pp. 317–330, 2 figs., 1943. [English summary.]

Of twelve adhesives for Bordeaux mixture tested on potatoes in the absence of early or late blight (*Alternaria solani* and *Phytophthora infestans*, respectively) in 1942 in São Paulo, Brazil, cassava flour (150 gm. per 100 l.), 'beko' fish oil (670 c.c. previously emulsified with 330 c.c. of a 20 per cent. sodium sulphite solution per 100 l.), and 'matarazzo' rice starch (150 gm.) left significantly higher percentages of copper than the control (without a spreader). Powdered soap, kaolin, and casein 120 were approximately equal to the control, while glue, resin soap, casein 60, milk, and molasses proved definitely inferior. Fish oil was particularly effective during the third, very wet experimental period, when a number of the other adjuvants failed. The Eigenheimer variety was more susceptible than Konsuragis to foliar injury, which resulted principally from treatment with resin, soap, casein, and milk.

Miller (H. J.). **A comparison of laboratory and field retention and protective value of certain copper fungicides.**—*Phytopathology*, xxxiii, 10, pp. 899–909, 2 graphs, 1943.

The retention of a number of protective copper fungicides was determined in the laboratory at the Pennsylvania State College by direct chemical analyses of Pyralin plates sprayed under standard conditions. The resultant data showed a very high correlation with direct analytical determination of retention of the same materials on cherry leaves sprayed against *Coccomyces hiemalis* in 1940 and 1941, while very satisfactory agreement was also obtained by the spore-germination technique.

The maximum degree of retention was shown by Bordeaux mixture 2–4–100 and two formulae of tank-mix copper phosphate. Tenacity indices for the various preparations were calculated by multiplying the percentage of copper remaining on the foliage at a given sampling date by the total rainfall before this date and a total obtained by adding these three values for each of the treatments, which was then divided by the sum of the precipitation for the three weathering periods multiplied by 100 to give a value of less than 1. Computed in this way, the indices for the three above-mentioned compounds in 1940 were 0·555, 0·465, and 0·410, respectively, the corresponding figures for Tenn. '26' 3–3–100 and the same plus 1 pt. orthex, 1 pt. nufilm, 1 pt. spralastic, and summermulsion spredrite being 0·190, 0·235, 0·170, 0·085, and 0·070, respectively. In 1941 the highest index of 0·570 was again assigned to Bordeaux mixture 2–8–100, followed by cupro K 3–3–100 (0·345), Tenn. '26' 3–3–100 plus ½ lb. soy-bean flour (0·330), Tenn. '34' 2¼–3–100 (0·310), and copper hydro '40' 3–3–100 (0·305), the figures for the remaining nine fungicides ranging from 0·255 for Bordow 6–3–100 down to 0·085 for copper 'A' 1½–8–100. The control of leaf spot is expressed (for 1941 only, the differences in 1940 having been insignificant) as the percentage of leaves on 10th October with no infection on four tagged branches with 50 leaves per tag originally present. Bordeaux 2–8–100 received the highest rating of 64·7 per cent., followed by Bordow 6–3–100 (61·7) and Tenn. '34' 2¼–3–100 (54·2), the remaining

values ranging from 46·7 for Tenn. (dolomitic lime) down to 20·2 for cupro-K 3–3–100.

Very little correlation was found between control and retention of copper on cherry leaves in the orchard and on Pyralin plates in the laboratory or the tenacity index. There was, however, a significant correspondence between control and toxicity, expressed as LD50 [*R.A.M.*, xxii, p. 72], the maximum values for which in 1941 were assigned to Bordeaux 2–8–100 (0·150) and Bordow 6–3–100 (0·220). A significant correlation was further established between leaf spot control, tenacity index, and LD50.

From the results of these experiments it is concluded that laboratory methods of determining retention were reasonably accurate for the prediction of the same values in the orchard, but that toxicity to *C. hiemalis* was a much more important factor than retention in assessing the protective properties of the various fungicides.

Bertolet (E.). **The finishing of Army ducks with special reference to mildew proofing.**—*Amer. Dyest. Reptr*, xxxii, 10, pp. P214–P219, 226, 1943.

Valuable information is presented concerning the treatment of United States Army duck fabrics with preservatives against mildew [*R.A.M.*, xxii, p. 479]. Recent studies at the Jeffersonville Quartermaster Depot, corroborated by an independent laboratory, showed that copper oleate, equivalent to 0·2 per cent. copper on the weight of the finished fabric, permitted a tensile strength loss of 45 per cent. on 14-day soil burial. No such loss occurred when the amount of copper was increased to 0·3 per cent., as was also the case in the treatment of sandbags in England [ibid., xxi, p. 214]. Basic copper carbonate and cuprous or cupric oxide with a 0·5 per cent. copper content failed to prevent the development of mildew during 14 days soil burial, whereas copper oleate at an equivalent concentration gave perfect control. When cuprammonium is used, a 1 to 1·5 or even 2 per cent. copper content is desirable. The alleged protective action of cutch browns is attributable to the 1 per cent. copper sulphate used for dyeing them.

Zinc dimethyl dithiocarbamate is considered to be the most promising of the alkyl derivatives. Zinc soaps are usually rated as having half the fungicidal efficiency of comparable copper preparations, while cadmium, for which a high degree of toxicity has been claimed, proved inferior to zinc.

The fungicidal action of silver on *Aspergillus niger* was demonstrated by growing the mould in a liquid medium in silver dishes, and further work on the possibilities of utilizing the metal as a mildew-repellant are in progress. Some fungi have been inhibited by a concentration of 12½ p.p.m. silver, while for others a dosage of 100 p.p.m. is requisite. In a number of tests, silver was rated as less toxic than mercury but more so than copper.

Phenyl mercury compounds are very powerful fungicides. An application of 0·5 per cent. phenyl-mercuro-2, 2′, 2″ nitrilotriethanol lactate, a quarternary addition product soluble in water in all proportions, is now being made on Army duck. A non-water-soluble compound, 9-phenylmercuro-, 10-acetoxy-, 12-octadecenoic acid, is available for use in solvent solution. Since August, 1942, orthophenylphenol has conferred satisfactory protection against mildew on the duck for jungle packs, while excellent results have also been obtained with 1 per cent. pentachlorophenol, which is likewise effective as a fire- and water-repellant. Large-scale trials are also in progress with dihydroxy-dichlor-diphenylmethane, while another compound under observation is 2, 2′ dihydroxy 5, 5′ dichloro-diphenyl methane. Pentachlorophenol is less liable than ortho-phenylphenol to be lost through volatilization in steam. The former compound tends to crystallize on the surface of the fabric, but this inconvenience may be obviated by passing the treated material over hot drying cans. The two-bath method of applying orthophenylphenol in conjunction with aluminium acetate has been found most effective,

leading as it does to the formation of the relatively insoluble aluminium ortho-phenylphenate. The mercury, silver, and lead salts of pentachlorophenol are the only pentachlorophenates less soluble in water than the original compound: they may be formed on the fibre by double decomposition with the sodium salt in a two-bath treatment. Pentachlorophenol, unlike ortho-phenylphenol and dihydroxy-dichlor-diphenylmethane, does not lower the hydrostatic resistance of duck.

Van Niel (C. B.). **Biochemistry of micro-organisms.** *Ann. Rev. Biochem.*, xii, pp. 551–586, 1943.

Recent studies on the growth factors and metabolism of micro-organisms and on anti-bacterial agents [*R.A.M.*, xxii, p. 128] are summarized and critically discussed, the bibliography comprising 371 titles.

Fawns (H. T.). **Food production by micro-organisms. Part II.** *Food Manuf.*, xviii, 10, pp. 333–337, 1943.

This further instalment of the writer's survey of the available information on food production by micro-organisms [*R.A.M.*, xxii, p. 491] deals with the synthesis of fat by yeasts and moulds, including *Endomyces vernalis*, *Oospora lactis*, and *Penicillium* and *Aspergillus* spp. [ibid., xxii, p. 446].

Thaysen (A. C.) & Morris (Muriel). **Preparation of a giant strain of Torulopsis utilis.**—*Nature, Lond.*, clii, 3862, pp. 526–528, 1 fig., 1943.

Addition of camphor (30 mg. per 10 ml. wort agar) to cultures of *Torulopsis utilis* gave rise to a new strain of the fungus, designated *T. utilis* var. *major*, which showed increased size (average of 8·9 by 4·8 μ as against 7 by 3·8 μ in the standard strain) and volume (644 μ^3 as against 318 μ^3) of individual cells [cf. *R.A.M.*, xx, p. 548]. The new strain had also a shorter generation time under standard conditions of fermentation and possibly a higher phosphorus content of dry yeast than the standard. Tentative tests indicated that borneol and bornyl acetate, as well as camphene, are capable of inducing similar changes in this fungus, while colchicin and α-naphthylamine had no effect on cell size.

Castan (R.). **Recherches sur les conditions de tubérisation des stolons de Pomme de terre.** [Studies on the conditions of tuberization of Potato stolons.] *C.R. Soc. Biol., Paris*, cxxxv, 7–8, pp. 578–580, 2 figs., 1941.

The studies of Costantin, Magrou, Bouget, *et al.* have demonstrated the favourable influence on potato tuberization of mountainous virgin soils containing the symbiotic fungi regarded as essential to the process [*R.A.M.*, xviii, p. 341]. In a series of tests at the University of Bordeaux, Up-to-Date seed was sown in soil from the Municipal Garden on 29th May, 1940, and the seedlings potted on 27th June in ordinary sifted soil mixed with sand. One lot of plants (C) was placed in a courtyard surrounded by walls 15 to 20 m. in height, another (A) on a balcony at an elevation of 10 m. above the courtyard, while a third (B) was transferred for 45 days preceding harvesting from the courtyard to the balcony. The amount of light registered on the balcony was almost 3½ times as much as that falling in the courtyard. The total numbers of tubers produced in series (A), (B), and (C) over periods of 120 to 140, 132, and 120 to 135 days, respectively, were 74, 19, and 4, respectively. The examination of the roots and rootlets failed to disclose the presence of symbiotic fungi, and it is therefore concluded that these organisms are not indispensable to tuberization, at any rate in the soils of low-lying regions. It is, however, obviously necessary to secure uniform conditions of illumination if conclusive experimental data are to be obtained.

Mattingley (G. H.). **Seed Potato certification scheme. Objects and conditions.**—*J. Dep. Agric. Vict.*, xli, 9, pp. 433–436, 5 figs., 1943.

The seed potato certification scheme established in Victoria in 1938 [*R.A.M.*, xx, p. 77] provides for the examination of a sample of the seed stock from which the crop submitted for certification is being grown and two subsequent field inspections. At the first inspection, made approximately eight weeks after planting, only fields with less than 10 per cent. unhealthy plants are passed, the grower being requested to rogue all affected plants. The standard of purity at the second inspection, made three or four weeks later, is : virus diseases less than 2 per cent., other diseases less than 1 per cent., and rogues less than 1 per cent. Crops which satisfy these standards are approved subject to the normal potato inspection when the tubers are ready for dispatch.

The main virus diseases of potatoes in Victoria are stated to be mild mosaic [crinkle] (caused by viruses A and X), rugose mosaic (viruses X and Y), and leaf roll. The Carman group of varieties [ibid., xxii, p. 269] is very susceptible to both types of mosaic; Snowflake, Up-to-Date, and the American varieties Katahdin and Sebago are immune from crinkle; Snowflake is very resistant to rugose mosaic; and all commercial varieties grown in Victoria, but particularly Up-to-Date, are susceptible to leaf roll.

Black (W.) & Cockerham (G.). **Some modern aspects of Potato production.** *Trans. Highl. agric. Soc. Scot.*, Fifth Ser., lv, pp. 37–53, 1943.

Up-to-date information on potato virus diseases, late blight [*Phytophthora infestans*], and other matters relating to the successful and efficient management of the potato crop in Scotland is presented in a popular form.

Salaman (R. N.). **Recent research in Potato breeding.**—*Emp. J. exp. Agric.*, xi, 43–44, pp. 125–139, 1943.

In this paper, the author discusses the influence that wart disease (*Synchytrium endobioticum*) has exercised on potato breeding, the effect of virus diseases in producing degeneration of potato varieties, the production of virus-resistant varieties, and the effects of recent Russian investigations on potato-breeding. The question of blight (*Phytophthora infestans*) resistance is touched on, and after reviewing future possibilities in the light of past experience the paper concludes with a table setting out (a) the characters required by breeders in potatoes to meet the physiological requirements of the plant, and (b) the sources (usually in wild species) found to be endowed with such qualities. A bibliography of 72 titles is appended.

Bald (J. G.). **Estimation of the leaf area of Potato plants for pathological studies.** *Phytopathology*, xxxiii, 10, pp. 922–932, 2 graphs, 1943.

A method devised by N. C. Thirumalachary (*Indian J. agric. Sci.*, x, pp. 835–841, 1940) for the measurement of the leaf areas of experimental plants was found greatly to facilitate this normally laborious process. A series of standards is secured by making tracings of leaves graded in size from the smallest to the largest, the tracings are numbered serially, and each leaf on the test plants is matched with the standard nearest in size, the area of the leaf being recorded by the application to it of the number of the corresponding standard. In the author's modification and extension of this technique to the measurement of entire plants, the areas of all leaves on a few plants of varying size in a plot are compared with a set of standard leaves, the total area for each plant is referred to a scale covering the whole range of plant size, and the plants assigned numbers according to their

relative positions on the scale. They are then used as standards for computing the dimensions of all plants in the plots.

This very rapid and reasonably accurate method was applied to a block of 864 potato plants of two early (Early Carman and Western Australian Delaware), and two late (Up-to-Date and Tasmanian Brownell) varieties, arranged in 16 rows of 54, and forming part of an investigation on the transmission of leaf roll at the Division of Plant Industry, Canberra. The rates of increase in leaf area of the early and late varieties were similar until the former began to flower, after which they declined in comparison with those of the latter. Long-standing infection with leaf roll materially reduced the rate of increase in leaf area. Emergence continued over a longer period, and considerably under 100 per cent. of the seed tubers produced plants, the growth of which was slower and less regular than that of healthy ones of the same and other varieties. Many of the affected plants appeared to acquire a more vigorous habit during early November, reflected in the increase of leaf area between 31st October and 12th November. The initial slow growth was apparently due to the prevalence among the seed tubers of internal necrosis and thin sprouts, expressive of conditions very adverse to the translocation of nutrient substances and their application to the development of new tissues in the young plants.

Sleesman (J. P.) & Wilson (J. D.). **Comparison of fixed coppers and Bordeaux mixture in the control of insects and diseases on muck-grown Irish Cobbler Potatoes.**—*Bi-mon. Bull. Ohio agric. Exp. Sta.*, xxviii, 223, pp. 173–183, 1943.

A tabulated account is given of experiments conducted on muck soil at McGuffy, Ohio, from 1934 to 1942, inclusive, to determine the comparative efficacy of Bordeaux mixture, fixed copper compounds, sulphur, and combinations of the two latter in the control of early and late blights (*Alternaria solani* and *Phytophthora infestans*) and the potato leafhopper and flea-beetle (*Empoasca fabae* and *Epitrix cucumeris*, respectively), on Irish Cobbler potatoes.

The resultant data show, *inter alia*, that modifications of the copper-lime ratio in the Bordeaux formula did not induce significant differences in leafhopper populations, disease control, or yield; that no appreciable benefit as regards insect control or yield accrued from the addition of calcium arsenate to Bordeaux mixture and a fixed copper dust; that the copper-lime dusts, copper oxychloride sulphate (COC-S), copper A compound, tribasic, and cuprocide Y, were comparable to Bordeaux mixture in insecticidal and fungicidal efficiency and stimulation of production, the oxychlorides giving superior leafhopper control and better yields than the basic sulphate or the oxide; and that the admixture of sulphur with fixed copper compounds was of doubtful value.

Bonde (R.), Schultz (E. S.), & Raleigh (W. P.). **Rate of spread and effect on yield of Potato virus diseases.**—*Bull. Me agric. Exp. Sta.* 421, 28 pp., 1943.

This bulletin contains the results of observations on the spread of potato virus diseases in Maine [*R.A.M.*, xxii, p. 222], and of studies of potato yields conducted on Long Island, New York, and in Aroostook County, Maine.

The spread of potato virus diseases in Maine during the 19-year period from 1924 to 1942 was found to vary from season to season: of mild mosaic [crinkle] from 4 to 97 per cent., leaf roll from 2 to 100 per cent., and spindle tuber from 1 to 61 per cent. The spread was most extensive in seasons most favourable to insect vectors common in Maine, namely *Myzus persicae*, *M. pseudosolani*, *Macrosiphum solanifolii*, and *Aphis abbreviata*, the first-named of which is believed to be, potentially at least, the most effective carrier of potato virus diseases studied.

Data for the five-year period, 1926 to 1930, showed that certification of seed

stock based on inspection in the field is unreliable, mainly owing to the masking of symptoms and late current-season infection, which easily escapes detection. On the other hand, advance testing of tuber samples of seed stock either in the greenhouse or in Florida gave a good index of the virus disease content.

The yields of Green Mountain and Bliss Triumph potatoes, when completely infected with leaf roll, spindle tuber, and the different types of mosaic, were significantly reduced, the reduction in 1928 ranging between 18 and 56 per cent. in Maine and between 26 and 64 per cent. on Long Island. The reductions in yield of Green Mountain due to crinkle, leaf-rolling mosaic and spindle tuber under Maine conditions amounted to 22, 27, and 18 per cent., respectively, and those due to crinkle mosaic, rugose mosaic, and leaf roll to 46, 50, and 45 per cent., respectively, whilst on Long Island spindle tuber reduced the yield 42 per cent. and leaf roll 53 per cent. Seed stocks with giant-hill abnormality, a late-maturing mutant of the Green Mountain variety, yielded slightly more than healthy ones in Maine and 26 per cent. less than healthy ones on Long Island. The early variety Bliss Triumph yielded more on Long Island than did Green Mountain, indicating that the conditions there in 1928 were more favourable for the earlier-maturing potatoes.

It thus appears that reductions in yield are not always directly proportionate to the amount of virus disease present, and are influenced by varietal and seasonal conditions, as well as by the location. In Maine in 1938 and 1939, leaf roll did not significantly reduce the yield in Irish Cobbler potatoes until 20 to 30 per cent. of the plants were infected, whereas in the Green Mountain variety a significant yield reduction was caused by a 12 per cent. infection; in 1939, less than 30 per cent. mild mosaic produced no significant reduction in yield, while 12 per cent. rugose mosaic caused one in the Green Mountain variety.

The more extensive spread of leaf roll in Maine since 1937 is attributed in part to the fact that improved cultural practices have protracted the growing period of the potato crop, thus allowing a longer time for the aphids to feed and to disseminate the virus, as well as for the virus to pass from leaves through stems to tubers.

Although the results of these studies have shown that the presence of relatively low percentages of virus diseases in seed potatoes may not materially reduce the yield, experience, on the other hand, has shown that when insect vectors are numerous, seed stocks with from 1 to 5 per cent. mosaic or leaf roll may produce 50 or 100 per cent. diseased plants in the following year. The importance of maintaining rigid control of virus diseases and of the production of disease-free seed potatoes is, therefore, again emphasized.

Virus diseases of Potatoes. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, liv, 8, pp. 358–362, 5 figs., 1943.

Of the virus diseases stated to attack potatoes in New South Wales [*R.A.M.*, xxii, p. 173], leaf roll is the most important in the widely-grown variety Factor, and may reduce the yield by one-half or more. Mosaic [including potato virus X], which may cause serious losses in other varieties, occurs as rugose, mild, aucuba, or other types, varying considerably in their effect on yield. Witches' broom causes the production of a large number of tubers, none or only few of which are of marketable size. Bronze wilt [caused by the tomato spotted wilt virus: ibid., xxii, p. 369] may be of importance near large towns. The chief means of controlling virus diseases is the selection of healthy seed, which should be carried out in the field, where foliage can serve as indicator. In tableland districts suitable for seed-growing, recommendations consist in maintaining stud seed plots, culling-out of weak-shooted tubers before planting, and roguing infected plants as early in the season as possible.

SMALL (T.). **Black scurf and stem canker of Potato (Corticium solani Bourd. & Galz.). Field studies on the use of clean and contaminated seed Potatoes and on the contamination of crop tubers.**—*Ann. appl. Biol.*, xxx, 3, pp. 221–226, 1943.

The results of field trials conducted on infected soil at Warburton, Cheshire, in 1941 and 1942 showed that black scurf and stem canker (*Corticium solani*) [*R.A.M.*, xxi, p. 591] developed on potato crops grown from clean, as well as from contaminated seed, but that it was more severe on the latter. Seed treatment with a proprietary organo-mercury preparation gave little, if any, control. The yields from clean-seed plots were no greater than those from the contaminated, and there was no relation between the yield and the amount of black scurf on the tubers in any of the trials. In one 1942 trial stem canker was present on 209 of the growing shoots on 78 of 100 plants from contaminated seed, the number of healthy shoots being 289, and on only 41 shoots on 19 of 100 plants from clean seed, there being 423 healthy shoots. Young tubers were present on 95 plants from the clean-seed plots, the total being 691, and on only 49 plants from the contaminated-seed plots, with a total of 132; there were 19 diseased stolons on the former and 36 on the latter plots. These results are taken to indicate that despite favourable conditions for the disease and the prevalence of *C. solani* in the soil, the attack on the young shoots and the check to tuber formation were caused mainly by the fungus on the seed tubers and not by that in the soil. It is assumed that plants raised from contaminated seed are severely attacked early in the season, but recover almost completely later on.

More black scurf occurred on late-dug than on early-dug crops in 1941, while in 1942 the attack was earlier and more severe, and even the earliest dug crop was heavily contaminated. Inoculation of seed at planting time did not affect the results. Misses and wilted shoots were rare in all trials; and in most cases fresh shoots were growing from the dead primary shoot or directly from the tuber. The amount of black scurf was only very little reduced by late planting, nor were the yields affected. All potato varieties tested, namely Arran Banner, Kerr's Pink, King Edward, and Majestic, were heavily infected but recovered well from probable early attacks on the young shoots. It is concluded that *C. solani* in the soil or on the seed causes little, if any, loss under ordinary farm conditions in this country.

WALLACE (T.) & WAIN (R. L.). **The blackening of cooked Potatoes.**—*J. Minist. Agric.*, l, 9, pp. 425–428, 1943.

It was demonstrated in a field experiment carried out in 1942 at Long Ashton that blackening of cooked potatoes [*R.A.M.*, xxii, p. 105] may result from deficiency of potassium (accentuated by high nitrogen) or of phosphorus. A sand culture experiment confirmed the effect of the latter deficiency and showed that the blackening was associated with the highest content of iron in the tubers. A discoloration was also caused by calcium deficiency, but is considered to be distinct from the typical blackening noted in the above two cases. It is suggested that the accumulation of iron may occur in different ways in the cases of potassium and phosphorus deficiencies. With the former there is no evidence that the intake of iron by the plant is increased, but iron tends to become immobile owing to excessive oxidation and to accumulate at points such as nodes; with the latter, on the other hand, an increased absorption of iron and its increased mobility in the plant may occur, as phosphate acts as a precipitant. The fact that blackening did not result from potassium deficiency in the sand culture is taken to indicate that the problem is complicated.

Schultz (E. P.). **Las proximas siembras del Arroz con especial referencia a la enfermedad de la 'brusone' ('Piricularia oryzae').** [The next Rice sowings, with special reference to the 'blast' disease (*Piricularia oryzae*).]—*Circ. Estac. exp. agríc. Tucumán* 118, 3 pp., 1943.

Since the first observation of rice blast (*Piricularia oryzae*) in Tucumán, Argentina [*R.A.M.*, xiv, p. 529], the disease has reappeared at intervals, mostly in a sporadic form and during periods of scanty rainfall. The first symptoms—discoloration of the upper parts of the shoots and drooping of the tips of the ears—generally appear about the middle or end of March, but in 1943 the yellow or chestnut lesions of the fungus developed at the beginning of February in the Río Chico plantations, and between the end of the month and mid-March infection spread extensively throughout the south, especially among the debilitated dry-land crops. In the Santa Catalina district, where the pathogen assumed an exceptionally virulent form, its spores were conveyed by the wind to a planting of Blue Rose under irrigation, 40 m. away, in an otherwise perfect state of health and development, the severity of infection gradually declining with distance from the focus until complete freedom was reached at 80 m.

In experiments to determine the transmissibility of *P. oryzae* by means of the seed, plots of Giant Japanese, Lady Wright, and Late Caloro, raised from seed from diseased plantations, contracted heavy infection, resulting in a yield reduction of 50 to 60 per cent., which did not, however, spread to the surrounding Blue Rose crops. Since the pathogen overwinters in the soil and during the summer attacks at least one wild grass, *Panicum sanguinale* [ibid., xx, p. 423], it may develop even where due precautions are taken for its exclusion, notably through the use of seed from perfectly sound plantings. As a result of the severe epidemic of blast in 1943, there is likely to be a shortage of healthy dry-land seed, and plantings of this type of rice should therefore be separated by at least 100 to 200 m. from crops grown under irrigation, the intervening space being preferably occupied by a field of maize, sorghum, sunflower, soy-bean, or the like. The purchase of foreign varieties of aquatic rice is very inadvisable, since they are frequently unsuited to local conditions, and may introduce new diseases into the country. The possibilities of combating *P. oryzae* by means of seed disinfection require further testing.

Niederhauser (J. S.). **A bacterial leaf spot and blight of the Russian Dandelion.**—*Phytopathology*, xxxiii, 10, pp. 959–961, 1943.

A full description is given of *Xanthomonas taraxaci* n.sp., the agent of a severe leaf spot and blight of *Taraxacum kok-saghyz* affecting 15 per cent. of the plants in a test plot at Ithaca, New York, during cloudy, wet weather in September to mid-October, 1942. The black, yellow-bordered lesions range in size from minute dots to necrotic areas covering almost the entire lamina. Ordinarily the outer leaves are most severely attacked. The rod-shaped, motile, uniflagellate, Gram-negative bacterium isolated from the infected tissues occurs singly or in pairs and measures (at 24 hours on potato dextrose agar at 27° C.) 1·4 to 3·3 by 0·7 to 1·2 (average 2·3 by 0·9) μ. Growth is moderate on beef extract-peptone agar and abundant on potato dextrose agar, the colonies on the former medium being circular, smooth, and bright yellow and on the latter pale yellow, mucoid, and glistening. *X. taraxaci* grows well in milk, reducing litmus and precipitating and slowly digesting a soft casein curd, tyrosine crystals being extensively produced in the supernatant liquid. The minimum, optimum, and maximum temperatures for growth are 0° to 3°, 30°, and 38° C., respectively. The organism develops well in gelatine and in tryptophane broth, rapidly liquefying the former and evolving hydrogen sulphide, but not indol, from the latter. Nitrate and ammonium salts can be utilized as a source of nitrogen; nitrates are not reduced to nitrites; lipase is formed. Acid is produced from xylose, dextrose, galactose, levulose, lactose,

sucrose, and glycerol; the salts of acetic, citric, lactic, malic, and succinic acids are utilized with an increase in the hydrogen-ion concentration; and starch is hydrolysed. The sodium chloride tolerance of the pathogen lies between 3·25 and 5 per cent.

Positive results were obtained in inoculation experiments on both wounded and uninjured leaves, the lesions being typical of those in the field, and the organism was consistently reisolated in pure culture.

Presley (J. T.). **Some diseases affecting cultivated Guayule in the Southwest during 1942.**—*Plant Dis. Reptr*, xxvii, 3–4, pp. 94–96, 1943. [Mimeographed.]

Short, popular notes are given on diseases affecting cultivated guayule [*Parthenium argentatum*] in the nursery and field. Nursery seedlings are affected by damping-off, associated with species of *Pythium*, *Rhizoctonia*, and *Fusarium*, wilt (*Verticillium albo-atrum*), crown rot (where excessive watering is practised) due to the water-moulds *Pythium* and *Phytophthora*, cottony rot (*Sclerotinia sclerotiorum*), and *Botrytis* rot, caused by the *Botrytis* stage of a species of *Sclerotinia*. Diseases observed in the field include *Sclerotinia* rot, *Verticillium* wilt, crown rot apparently due to *Pythium* and *Phytophthora*, and Texas root rot (*Phymatotrichum omnivorum*) [*R.A.M.*, xxii, p. 496]. Inoculation experiments demonstrated that *Sclerotium rolfsii* is able to attack and destroy guayule plants, and must be considered a potential menace to field plantings.

Marsh (A. W.) & Bollen (W. B.). **Effect of manganese on the microflora and respiration of some Oregon soils.**—*J. Amer. Soc. Agron.*, xxxv, 10, pp. 895–900, 1 graph, 1943.

Manganese sulphate added to several Oregon soils at rates equivalent to 40 and 100 lb. per acre increased the [unspecified] mould count in Willamette silty clay loam and Braillier peat by about 100 per cent., and the bacterial population in the latter by 160 per cent. The same treatment produced a 50 per cent. decrease in the mould count in Newberg loamy sand.

The microbial production of carbon dioxide was increased by manganese sulphate (100 lb. per acre) in the Klamath peat and Newberg soils, but in Chehalis silty loam the compound apparently exerted no effect. The response was in roughly inverse proportion to available manganese.

Pohlman (G. G.) & Nottingham (R. J.). **Numbers of micro-organisms in relation to aggregate size.**—*Iowa St. Coll. J. Sci.*, xv, 4, pp. 447–450, 1941.

An examination of soil aggregates of various sizes revealed no significant differences in the numbers of fungi and bacteria, variations within triplicate plates from the same aggregate being in most cases greater than between those from different ones. Nor could the numbers of Actinomycetes on the bacterial plates be correlated with size of aggregates. It is considered that the results of this preliminary study lend support to the conclusions of Myers and McCalla (*Soil Sci.*, 51, pp. 189–200, 1941) that the effect of micro-organisms in stabilizing soil aggregates [*R.A.M.*, xxi, p. 221] is due to their products rather than to the organisms themselves.

Brenchley (Winifred E.). **Minor elements and plant growth.**—*Biol. Rev.*, xviii, 4, pp. 159–171, 1943.

Following an introductory note on the relation of 'trace' elements to plant growth, the available information on the subject is critically reviewed under the headings of boron, copper, iodine, manganese, molybdenum, selenium, zinc, and other elements, viz., arsenic, barium, chromium, cobalt, lead, lithium, nickel,

rubidium, strontium, thallium, and vanadium. A three-page bibliography is appended.

ARNON (D. I.). **Mineral nutrition of plants.**—*Ann. Rev. Biochem.*, xii, pp. 493–528, 1943.

Included in this critical survey of recent contributions to the study of the mineral nutrition of plants are a number of references to work dealing with this factor in relation to plant diseases.

MILLER (J. H.). **The starting point for nomenclature of the fungi.**—*Mycologia*, xxxv, 5, pp. 584–589, 1943.

The author discusses the divergence of opinion regarding the interpretation of Article 19, f, of the International Rules of Botanical Nomenclature which states that Fries, *Systema Mycologicum*, 1821–1832, is the starting-point for the nomenclature of all fungi except Uredinales, Ustilaginales, and Gasteromycetes. He considers that the logical procedure is to accept the name recognized by Fries in the *Systema* and stresses the confusion that would arise if the starting date were altered to 1821. Other subjects discussed are the method of citing the authority for the specific name and the choice of specific names used in the *Systema*.

BRIEN (R. M.). **First supplement to 'A list of plant diseases recorded in New Zealand'.**—*N.Z. J. Sci. Tech.*, A, xxiv, 1, pp. 62–64, 1942.

This first supplement to the author's list of New Zealand plant diseases [*R.A.M.*, xviii, p. 726], comprising 35 maladies of fungal, bacterial, virus, and physiological origin on 36 hosts, contains the following new records: *Verticillium dahliae* on *Acer palmatum*, *Rhynchosporium secalis* on *Agropyron repens* and *Hordeum murinum*, tobacco mosaic virus on chilli, *Elsinoe fawcetti* on lime (*Citrus aurantiifolia*), *Botrytis cinerea* on *Euphorbia peplus* and *Fragaria* sp. (cultivated), *Marssonina panattoniana* on lettuce, *Pythium de Baryanum* and *V. dahliae* on tomato, *Stagonospora curtisii* on cultivated *Narcissus*, *Sphacelotheca panici-leucophaei* on *Panicum miliaceum*, *Sclerotinia sclerotiorum* on *Petunia* sp., and *Phytomonas* [*Bacterium*] *tumefaciens* on rhubarb and loganberry.

HANSFORD (C. G.). **Host list of the parasitic fungi of Uganda. Parts I, II, and III.**—*E. Afr. Agric. J.*, viii, 4, pp. 248–252; ix, 1, pp. 50–55; 2, pp. 102–106, 1943.

The author has revised his original host list of the parasitic fungi of Uganda [*R.A.M.*, xvii, p. 345] in the light of recent research and incorporated in the present contribution a considerable number of new records [ibid., xx, pp. 596, 597].

KERN (F. D.). **The importance of taxonomic studies of the fungi.**—*Torreya*, xliii, 1, pp. 65–77, 1943.

In this paper, read at the 75th Anniversary Celebration of the Torrey Botanical Club at the New York Botanical Garden, 23rd June, 1942, the author gives an historical survey of taxonomic studies of the fungi and discusses some of the contemporary aspects of nomenclature.

Virus names used in the Review of Applied Mycology.—44 pp., Imperial Mycological Institute, 1944. [Mimeographed.]

This *Review* has consistently refrained from adopting any system for the 'scientific' nomenclature of viruses since no system yet invented has obtained international acceptance. In the past a virus has been indexed either under the English common name of the disease it causes or under some other widely used designation.

The common names for many diseases are accepted throughout the English-

speaking world, they are frequently without ambiguity, and they will presumably continue to be used after the viruses have received internationally acceptable scientific names. It has been decided, therefore, to index viruses in this *Review*, with one or two exceptions, under names derived from the English common names of the diseases they cause, i.e., tobacco mosaic virus, cranberry false blossom virus. To this end an effort is being made to standardize disease names and after consultation with a number of virus workers and official plant pathologists this tentative list of disease names and of the virus names of the causal viruses accepted in the *Review* together with many of their synonyms has been compiled.

It is intended eventually to issue a revised version in printed form.

[A limited number of copies of this mimeographed list are available at the price of 1*s.* 0*d.* post free.]

FULLING (E. H.). **Plant life and the law of man IV. Barberry, Currant and Gooseberry, and Cedar control.**—*Bot. Rev.*, ix, 8, pp. 483–592, 2 maps, 1943.

The author has assembled a quantity of useful information relating to legislation for the eradication and quarantine of alternate hosts as a means of combating three heteroecious fungal diseases, namely, black stem rust of wheat and other cereals (*Puccinia graminis*), white pine blister rust (*Cronartium ribicola*), and cedar-apple rust (*Gymnosporangium juniperi-virginianae*) with special reference to the United States. The section concerning each disease is furnished with a separate bibliography.

St. Lucia. Plant Protection Ordinance. No. 12 of 1942.—*Govt Gaz.*, pp. 31–40, 1942.

This Ordinance empowers the Governor in Council to make regulations providing for the prevention, eradication, and control of diseases and pests affecting plants, and supersedes Ordinance No. 30 of 1939.

Service and regulatory announcements April–June, 1943. Importation of plants and plant products by mail.—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, pp. 21–22, 1943.

To assist in the enforcement of the various orders, quarantines, and regulations prohibiting or limiting the entry into the United States by mail of certain plants or plant products, provisions have been made (30th June, 1943) by the Bureau of Entomology and Plant Quarantine of the Department of Agriculture, concurrently with the Postal and Customs Services, and are here cited, to insure the closer inspection of such importations.

Distribution maps of plant diseases.—Maps 25–48. Issued by the Imperial Mycological Institute, 1943. 3*s.* 9*d.*

The second year's issue of this series of maps showing the world distribution of major crop diseases [*R.A.M.*, xxii, p. 48] comprises (No. 25) cotton leaf curl virus, (26) *Corynebacterium michiganense* on tomato, (27) *Dothidella ulei* on *Hevea* rubber, (28) *Peronospora schachtii* on beet, (29) sugar-cane chlorotic streak, (30) *Stereum purpureum* on plum, apple, hardwoods, etc., (31) *Fusarium oxysporum* var. *cubense* on banana, (32) *F. lini* on flax, (33) *Xanthomonas albilineans* on sugar-cane, (34) *Spongospora subterranea* on potato, (35) *Phytophthora citrophthora* on citrus, (36) *Ceratostomella ulmi* on elm, (37) *Marasmius perniciosus* on cacao, (38) *Nectria galligena* on apple, (39) *X. rubrilineans* on sugar-cane, (40) *Puccinia antirrhini* on *Antirrhinum*, (41) *X. stewarti* on maize, (42) *Phaeocryptopus gaeumanni* on *Pseudotsuga taxifolia*, (43) rice dwarf disease, (44) *Sclerotinia laxa* on fruit, (45) *Exobasidium vexans* on tea, (46) onion yellow dwarf, (47) *Phytophthora hibernalis* on citrus, and (48) *Dibotryon morbosum* on plum and other *Prunus* spp.